JOHN DEERE 300, 312, 314, AND 316 HYDROSTATIC TRACTOR

Service Manual

SM-2104 (Nov-78)

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INTRODUCTION

This service manual contains service and maintenance information for the John Deere 300, 312, 314 and 316 Hydrostatic Tractors.

The manual is divided into sections. Each section pertains to a certain component or operational system of the tractor. The information is divided into groups within each section.

Emphasis is placed on diagnosing malfunctions, analysis and testing. Diagnosing malfunctions includes possible troubles, their causes and how to correct them. Under specific components these troubles are analyzed to help you understand what is causing the problem. In this way, you can eliminate the cause rather than just replace parts and have the same problem keep recurring.

Metric equivalents have been included, where applicable, throughout this service manual.

Specifications are found in the last group of each section.

Vertical lines appear in the margins of many of the pages. These lines identify new material and revised information that affects specifications, procedures and other important instructions.

Whenever new or revised pages are provided, insert them into your manual as soon as you receive them. Your service manual will always be up-to-date and be a valuable asset in your service department.

⚠ This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

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SERIAL NUMBERS

Tractor Serial Number

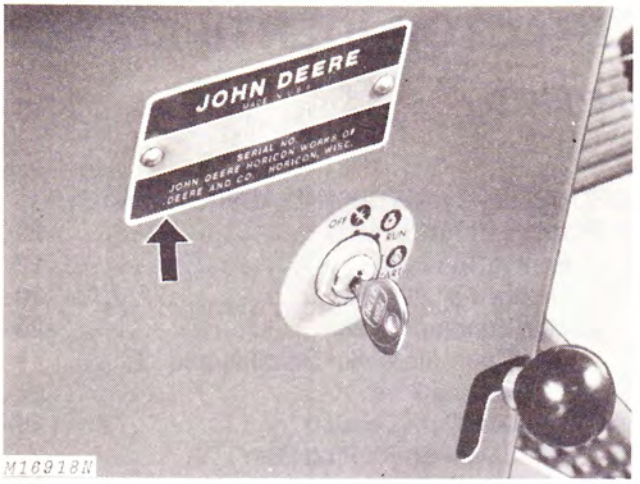

Fig. 1-Tractor Serial Number

The tractor serial number plate is located on the pedestal just above the key switch, Fig. 1.

Engine Serial Number

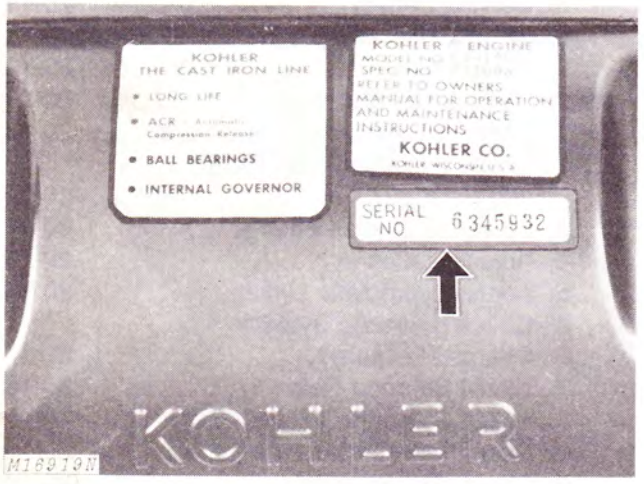

Fig. 2-Engine Serial Number

The engine serial number is located on the top of the blower housing, Fig. 2.

Transmission Serial Number

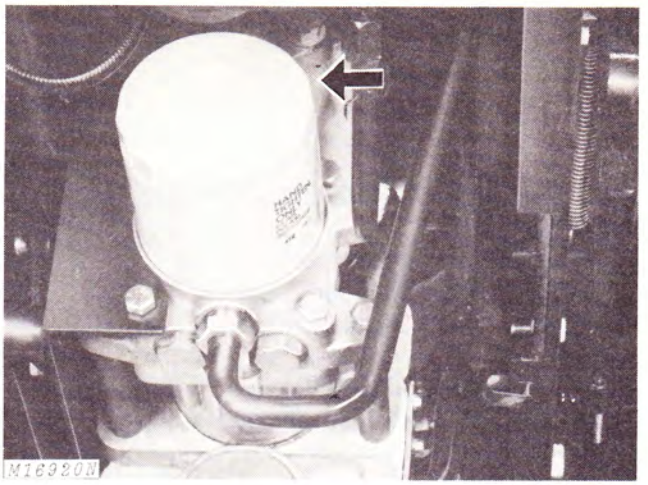

Fig. 3-Transmission Serial Number

The transmission serial number is located above the oil filter on the front of the transmission.

Group 10
SPECIFICATIONS

300 AND 316 TRACTOR SPECIFICATIONS

Engine

Engine Model Number	K341AQS
Manufacturer	Kohler
Cylinder	One
Cycle	Four
Bore	3.750 inch (9.52 cm)
Stroke	3.250 inch (8.25 cm)
Displacement	35.89 cu. inch (588.237 cc)
Horsepower*	16 (11.94 kW)
Speeds	
Idle	2000 to 2200 rpm
High (No load)	3400 to 3500 rpm

**Horsepower rating is established by engine manufacturer in accordance with Standard International Combustion Institute procedure. It is corrected to 60°F. and 29.92 hg barometer. Laboratory test engines are equipped with air cleaner and muffler.*

Electrical System

Battery, John Deere (AM31186)	12-Volt, BCI Group 22F
Charging Capacity	15 amps
System Polarity	Negative Ground
Starter	12-Volt Motor, Key and Solenoid
Ignition	Battery Coil
Spark Plug	Champion H10, AC 45L, Prestolite 14-L7B *Resistor-Type Champion RH10
Spark Plug Gap	0.035 in. (0.889 mm)
Breaker Point Gap	0.020 in. (0.508 mm)
Timing	Index

Power Train

Hydrostatic Transmission Sundstrand 15 Series	(U-Type)
Differential	Dana
Brakes	Individual Rear Wheel (Drum-Type)

**In Canada, compliance with radio interference regulations certified. Replace spark plug with resistor-type spark plug only.*

Travel Speeds

Forward	Variable 0.5 to 6.5 mph (0.8 km/h to 10.5 km/h)
Reverse	Variable 0.5 to 3.5 mph (0.8 km/h to 5.6 km/h)

Hydraulics

Control Valve	2-Spool (Open-Center)
**Outlets	2 Sets (front)
Rockshaft	Mid-mounted

***300 Tractors (Serial No. 55001-70,000) were equipped with one set of outlets. A kit is available to convert these tractors to two sets of outlets.*

Filters

Engine Air Cleaner	M47494
Transmission Oil Filter	AM38441

Tire Size

Front	16 x 6.50-8 High-Flotation
Rear	23 x 10.50-12 High-Flotation

Tire Inflation*

Front	6 to 16 psi (41 to 110 kPa)
Rear	5 to 10 psi (34 to 69 kPa)

**Inflation will vary with attachment used.*

Wheel Tread

Front	31¼ inches (803.75 mm)
Rear (Wheels In)	30½ inches (774.70 mm)
Rear (Wheels Out)	33 inches (1838.20 mm)

Dimensions

Wheel Base	46 inches (1.168 m)
Over-all Length	69 inches (1.753 m)
Over-all Height	44 inches (1.118 m)
Over-all Width (Max.)	42 inches (1.079 m)

Approximate Curb Weight ..... 785 lbs (359.09 kg)

312 TRACTOR SPECIFICATIONS

Engine

Engine Model Number K301AS
Manufacturer . . . . . Kohler
Cylinder . . . . . One
Cycle . . . . . Four
Bore . . . . . 3.38 in. (8.58 cm)
Stroke . . . . . 3.25 in. (8.25 cm)
Displacement . . . . . 29.1 cu. in. (476.37 cc)
Horsepower* . . . . . 12 (8.94 kW)
Speeds
Idle . . . . . 2400 ± 100 rpm
High (No load) . . . . . 3500 ± 100 rpm

**Horsepower rating is established by engine manufacturer in accordance with standard International Combustion Institute procedure. It is corrected to 60°F. and 29.92 hg barometer. Laboratory test engines are equipped with air cleaner and muffler.*

Electrical System

Battery, John Deere
(AM31186) . . . . . 12-Volt, BCI Group 22F
Charging Capacity . . . . . 15 amps
System Polarity . . . . . Negative Ground
Starter . . . . . 12-Volt Motor, Key and Solenoid
Ignition . . . . . Battery Coil
Spark Plug . . . . . Champion H10, AC 45L, Prestolite 14-L7B *Resistor-Type Champion RH10
Spark Plug Gap . . . . . 0.035 in. (0.889 mm)
Breaker Point Gap . . . . . 0.020 in. (0.508 mm)
Timing . . . . . Index

Power Train

Hydrostatic Transmission
Sundstrand 15 Series . . . . . (U-Type)
Differential . . . . . Dana
Brakes . . . . . Rear Wheel (Drum-Type)

**In Canada, compliance with radio interference regulations certified. Replace spark plug with resistor-type spark plug only.*

Travel Speeds

Forward . . . . . Variable 0.5 to 6.5 mph (0.8 km/h to 10.5 km/h)
Reverse . . . . . Variable 0.5 to 3.5 mph (0.8 km/h to 5.6 km/h)

Hydraulics

Control Valve . . . . . Single Spool (Open-Center)
Rockshaft . . . . . Mid-mounted

Filters

Engine Air Cleaner
312 Tractor (Serial No. 70,001-80,000) AM31400
312 Tractor (Serial No. 80,001-) M47494
Transmission Oil Filter AM38441

Tire Size

Front . . . . . 16 x 6.50-8 High-Flotation
Rear . . . . . 23 x 8.50-12 High-Flotation

Tire Inflation*

Front . . . . . 6 to 16 psi (14 to 110 kPa)
Rear . . . . . 5 to 10 psi (34 to 69 kPa)
**Inflation will vary with attachment used.*

Wheel Tread

Front . . . . . 31¼ inches (803-75 mm)
Rear (Wheels In) . . . . . 30½ inches (774.70 mm)
Rear (Wheels Out) . . . . . 33 inches (1838.20 mm)

Dimensions

Wheel Base . . . . . 46 inches (1.168 m)
Over-all Length . . . . . 69 inches (1.753 m)
Over-all Height . . . . . 44 inches (1.118 m)
Over-all Width (Max.) . . . . . 42 inches (1.079 m)

Approximate Curb Weight . . . . . 760 lbs (344.5 kg)

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314 TRACTOR SPECIFICATIONS

Engine

Engine Model Number	K321AQS
Manufacturer	Kohler
Cylinder	One
Cycle	Four
Bore	3.50 in. (88.9 mm)
Stroke	3.25 in. (82.5 mm)
Displacement	31.3 cu. in. (513 cc)
Horsepower*	14 (10.43 kW)
Speeds	
Idle	2000 to 2200 rpm
High (No load)	3400 to 3500 rpm

**Horsepower rating is established by engine manufacturer in accordance with standard International Combustion Institute procedure. It is corrected to 60°F and 29.92 hg barometer. Laboratory test engines are equipped with air cleaner and muffler.*

Electrical System

Battery, John Deer (AM31186)	12 Volt, BCI Group 22F
Charging Capacity	15 amps
System Polarity	Negative Ground
Starter	12 Volt Motor, Key and Solenoid
Ignition	Battery Coil
Spark Plug	Champion H10, AC 45L, Prestolite 14-L7B *Resistor-Type Champion RH10
Spark Plug Gap	0.035 in. (0.889 mm)
Breaker Point Gap	0.020 in. (0.508 mm)
Timing	Index

Power Train

Hydrostatic Transmission Sundstrand 15 Series	(U-Type)
Differential	Dana
Brakes	Rear Wheel (Drum-Type)

**In Canada, compliance with radio interference regulations certified. Replace spark plug with resistor-type spark plug only.*

Travel Speeds

Forward	Variable 0.5 to 6.5 mph (0.8 km/h to 10.5 km/h)
Reverse	Variable 0.5 to 3.5 mph (0.8 km/h to 5.6 km/h)

Hydraulics

Control Valve	Single Spool (Open-Center)
Rockshaft	Mid-mounted

Filters

Engine Air Cleaner	M47494
Transmission Oil Filter	AM38441

Tire Size

Front	16 x 6.50-8 High-Flotation
Rear	23 x 10.50-12 High-Flotation

Tire Inflation*

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Dimensions

Wheel Base	46 inches (1.168 m)
Over-all Length	69 inches (1.753 m)
Over-all Height	44 inches (1.118 m)
Over-all Width (Max.)	42 inches (1.079 m)

Approximate Curb Weight ..... 760 lbs (344.5 kg)

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TORQUE CHARTS

Bolt Torque Chart

AVERAGE TIGHTENING TORQUE FOR BOLTS (BASED ON 85% OF YIELD)

BOLT SIZE	A17B			A17D			A17F		
	lb-in	lb-ft	Nm	lb-in	lb-ft	Nm	lb-in	lb-ft	Nm
1/4	72	6	8	120	10	13.5	168	14	19
5/16	156	13	17.6	240	20	27	360	30	40.7
3/8	276	23	31.2	420	35	47.5	600	50	67.8
7/16	420	35	47.5	660	55	74.6	960	80	108.5
1/2	660	55	74.6	1020	85	115.2	1440	120	162.7
9/16	900	75	101.7	1560	130	176.3	2100	175	237.3
5/8	1260	105	142.4	2040	170	230.5	2880	240	325.4
3/4	2220	185	250.8	3600	300	406.7	5100	425	576.2
7/8	1920*	160	216.9	5340	445	603.3	8220	685	928.7
1	3000	250	339	8040	670	908.4	12360	1030	1396.5
1 1/8	3960	330	447.4	10920	910	1233.8	17520	1460	1979.5
1 1/4	5760	480	650.8	15000	1250	1694.8	24720	2060	2793

B grade bolts larger than 3/4 are sometimes formed hot rather than cold, which accounts for the lower mean tightening torque.

Set Screw Seating Torque Charts

Screw Size	Seating Torque	
	Inch-Pounds	Newton Meters
#5	9	1.0
#6	9	1.0
#8	20	2.3
#10	33	3.7
1/4	87	9.8
5/16	165	18.6
3/8	290	32.8
7/16	430	48.6
1/2	620	70.1
9/16	620	70.1
5/8	1225	138.4
3/4	2125	240.1

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Group 15
FUEL AND LUBRICANTS

FUEL

Kohler Engines perform at peak efficiency when the below-listed fuel recommendations are followed:

CAUTION: Do not fill gas tank when engine is running or hot. Do not smoke when filling gas tank.

Wipe dust and dirt from around filler cap before removing it. Place cap in a clean area.

IMPORTANT: Do not permit dirt or other foreign matter to enter the fuel system. This may cause hard starting, poor performance and engine damage. Always use clean gasoline storage cans and funnels.

Fill the gas tank with fresh, clean non-leaded gasoline. Non-leaded gasoline is recommended because it reduces cylinder head deposits. Low-lead or leaded "regular" grades are acceptable.

DO NOT use premium, ethyl or white gasoline. The use of gasohol is not recommended. Never use special additives such as carburetor cleaners, deicers, or moisture-removing liquids in your gasoline.

IMPORTANT: Do not mix oil with gasoline.

LUBRICANTS

Effective use of lubricating oils and greases is perhaps the most important step toward low upkeep cost, long tractor life, and satisfactory service. Use only lubricants specified in this section. Apply them at intervals and according to the instructions in this section.

ENGINE OIL

This machine has been filled at the factory with break-in oil that can be used only between 32°F (0°C) and 75°F (24°C).

For first 5 hours of operation, use only the oils listed below:

- Below 32°F (0°C) — Drain break-in oil before using. Fill with SAE 5W-20.
- 32°F (0°C) to 75°F (24°C) — Use break-in oil.
- Above 75°F (24°C) — Drain break-in oil before using. Fill with SAE 30.

After the first 5 hours of break-in operation, drain the engine crankcase and refill with fresh oil.

Use John Deere TORQ-GARD SUPREME® engine oil for use in the engine crankcase. TORQ-GARD SUPREME oil was formulated to provide all the protection your engine needs, so never put additives in the crankcase.

If oil other than TORQ-GARD SUPREME is used, it must conform to one of the following specifications:

API Service Classification CC-SC-SD-SE-SF

Depending upon the expected prevailing temperature for the fill period, use oil of viscosity as shown.

Some increase in oil consumption may be expected when SAE 5W-20 oil is used. Check oil level frequently.

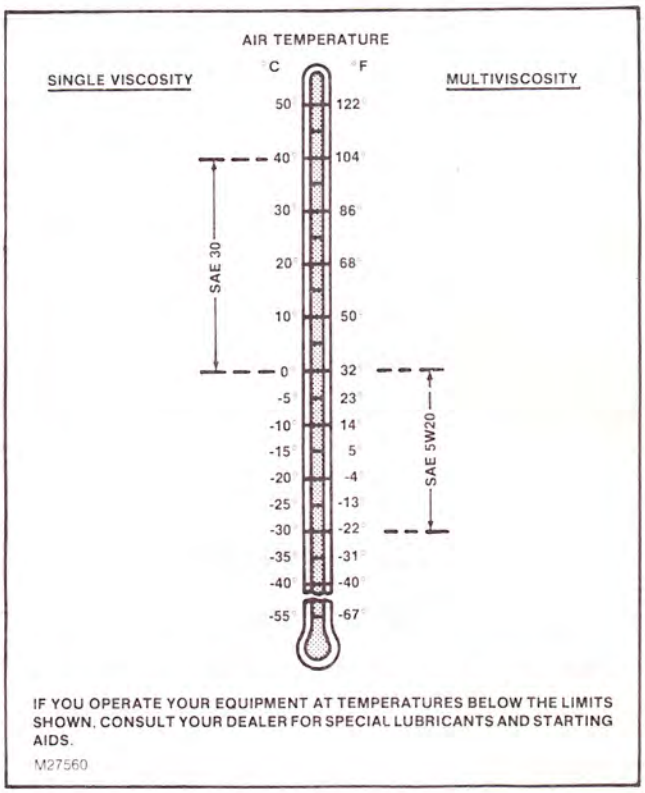

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Fig. 1-Engine Oil Temperature Chart

HYDRAULIC OIL

Use John Deere All-Weather Hydrostatic Fluid, John Deere HY-GARD® Transmission and Hydraulic Oil, or an equivalent Type "F" Automotive Automatic Transmission Fluid.

GREASE

John Deere Multipurpose Grease is recommended in all grease fittings. If other greases are used, use SAE Multipurpose Grease containing 3 to 5 percent molybdemum disulfide.

Use grease as shown in temperature chart.

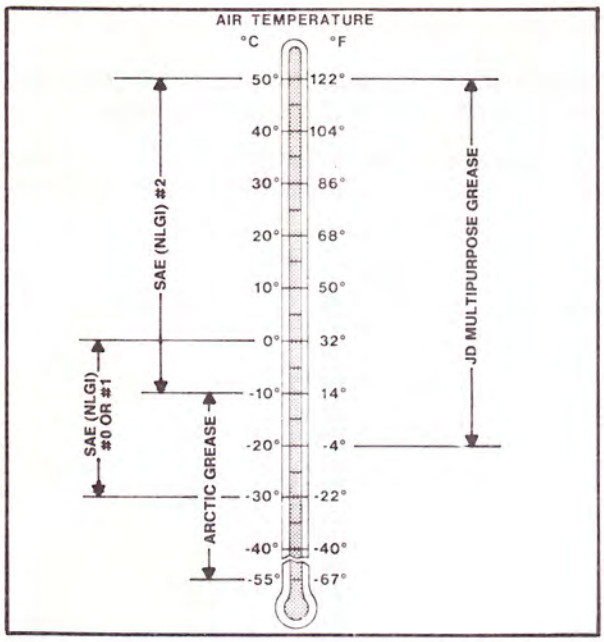

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Fig. 2-Grease Temperature Chart

CAPACITIES

Fuel Tank ..... 4.5 U.S. Gallons (17.034 l)

Crankcase ..... 3 U.S. Pints (1.419 l)

Transmission ..... 5 U.S. Quarts (4.731 l)

SERVICE INTERVALS

Crankcase (Oil Change)

Break-in..... First 5 hours

Regular..... Every 25 hours

Dusty Conditions..... Every 8 hours

Transmission

Oil Change ..... 500 hours or 2 years

Oil Filter Change ..... 100 hours

NOTE: Oil filter is positioned under transmission. Fill new filter ½ full of oil prior to installing it to prevent an air lock in the system.

Tractor Grease Fittings ..... 25 hours

CHECKING TRANSMISSION FLUID LEVEL

300 Tractors (Serial No. 30,001-71,160)

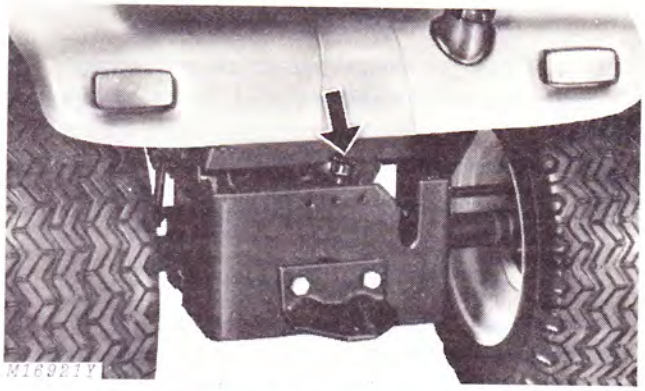

Fig. 3-Checking Transmission Fluid Level

NOTE: Check transmission fluid level with engine stopped and control lever in "neutral" position.

Remove dipstick, Fig. 3. Check that fluid level is at midpoint of "SAFE" range on dipstick.

If fluid level is low, add necessary amount through fill tube to bring fluid level up to midpoint of "SAFE" range on dipstick.

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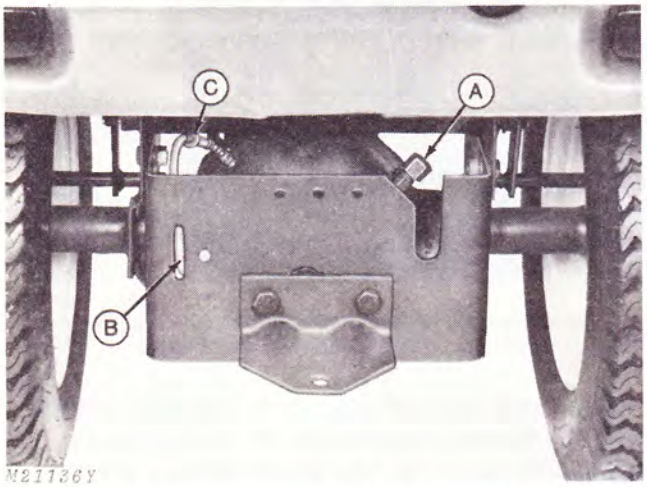
300 Tractors (Serial No. 71,161-80,000 and all 312, 314 and 316 Tractors)



A—Fill Tube Cap **C—Accumulator Vent**
B—Sight Tube

Fig. 4-Checking Transmission Fluid Level

NOTE: DO NOT run tractor engine when checking or adding fluid.

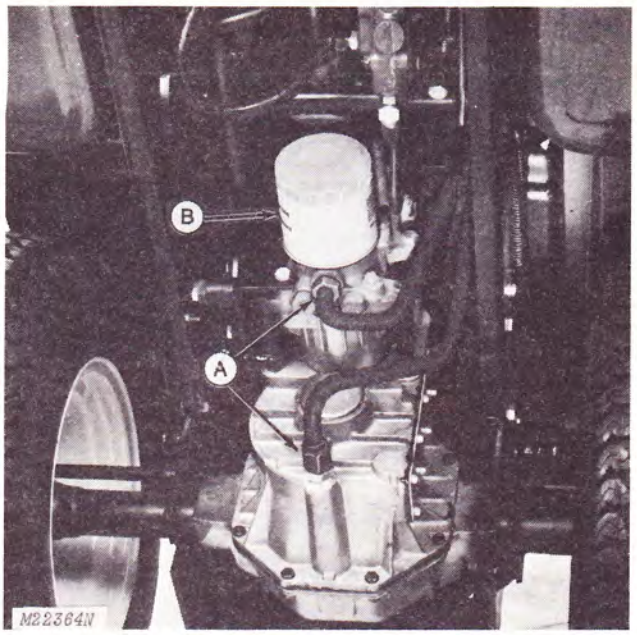
Fluid level in sight tube (B) should be ¼ to 1¼ inches (5 to 30 mm) above bottom of slot in frame, Fig. 4, when tractor engine is stopped.

IMPORTANT: The 1/16 inch diameter hole in outside wall of accumulator-vent (C) must be positioned at an upward angle to prevent fluid leakage and insure proper venting.

If fluid level is low, remove fill tube cap (A) and add necessary amount of fluid until it is ¼ to 1¼ inches (5 to 30 mm) above bottom of slot in frame.

IMPORTANT: Do not overfill.

CHANGING TRANSMISSION FLUID AND FILTER



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A—Transmission-to-Axle Cooling Tube **B—Filter**

Fig. 5-Changing Transmission Fluid and Filter

IMPORTANT: Be extremely careful to prevent dirt from entering hydraulic system. Clean dust and dirt from edges of filter (B), Fig. 5, around dipstick cap and transmission-to-axle cooling tube (A) before removing it.

Remove transmission-to-axle cooling tube (A).

Allow all fluid to drain into a container.

Reinstall transmission-to-axle cooling tube (A).

Remove filter (B). Fill a new filter half-full of transmission fluid. Moisten rubber filter gasket with fluid. Install filter finger-tight only.

Fill transmission with John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" Automotive Automatic Transmission Fluid.

Transmission capacity is 5 U.S. quarts (4.731 l). Pour in only 3 quarts (2.839 l). Check transmission fluid level as explained on page 10-15-2 before adding more fluid. Fill transmission to proper level.

IMPORTANT: Do not overfill.

CHECKING ENGINE CRANKCASE OIL LEVEL

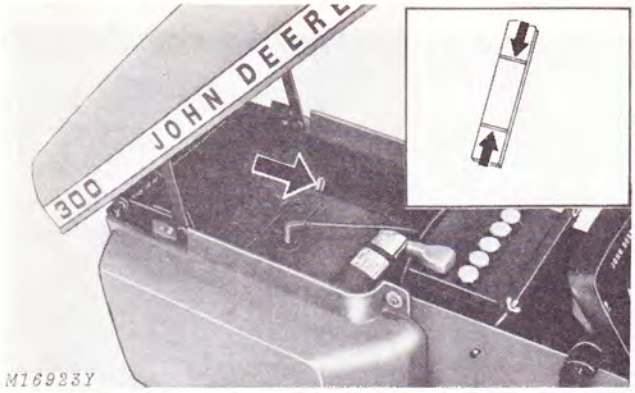

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Fig. 6-Checking Engine Crankcase Oil Level

Park tractor on level surface.

Stop engine and raise hood.

Wipe dust and dirt from around dipstick (arrow).

Remove dipstick, Fig. 6.

Check that oil level is within the safe range (between arrows) on the dipstick (see inset) when the dipstick is installed all the way.

CHANGING ENGINE CRANKCASE OIL

NOTE: Drain crankcase oil when oil is hot and all dirt and foreign material is in suspension.

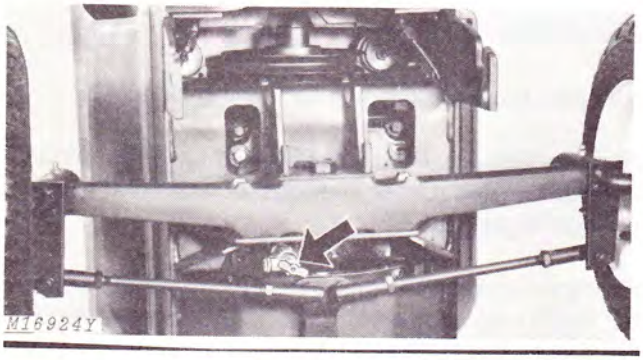

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Fig. 7-Changing Engine Crankcase Oil - 300 Tractors (Serial No. 30,001-55,000)

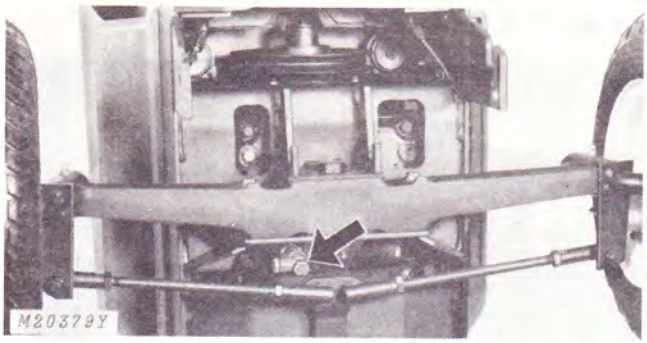

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Fig. 8-Changing Engine Crankcase Oil - 300 Tractors (Serial No. 55,001-80,000) and 316 Tractors

Turn oil drain valve (arrow) counterclockwise to open, Fig. 7, 300 Tractors (Serial No. 30,001-55,000), or Fig. 8, 300 Tractors (Serial No. 55,001-80,000) and 316 Tractors.

IMPORTANT: On 300 Tractors Serial No. 55,001-80,000, and 316 Tractors, use a hex. head wrench to loosen or open valve. When closing valve, do not use a wrench to tighten. Hand tighten only.

NOTE: Remove oil drain plug from the bottom of crankcase on 312 and 314 Tractors (not illustrated).

Drain oil into a container.

Close valve (clockwise) or install drain plug after oil has completely drained.

NOTE: For convenience, a suitable length of 5/8 inch (15.88 mm) garden hose or plastic tubing may be installed on the drain valve (300 and 316 Tractors) to allow oil to drain into a container away from the tractor.

Fill crankcase with the oil of the proper viscosity (see chart on page 10-15-1 to midpoint of two arrows on dipstick. Crankcase capacity is approximately 3 pints (1.419 l).

IMPORTANT: Check dipstick reading before pouring in the last ½ pint (0.2366 l). Fill only to midpoint of two arrow marks. The oil level should never be over the top arrow mark. Overfilling can cause engine overheating resulting in loss of power and permanent damage to the engine.

LUBRICATING GREASE FITTINGS

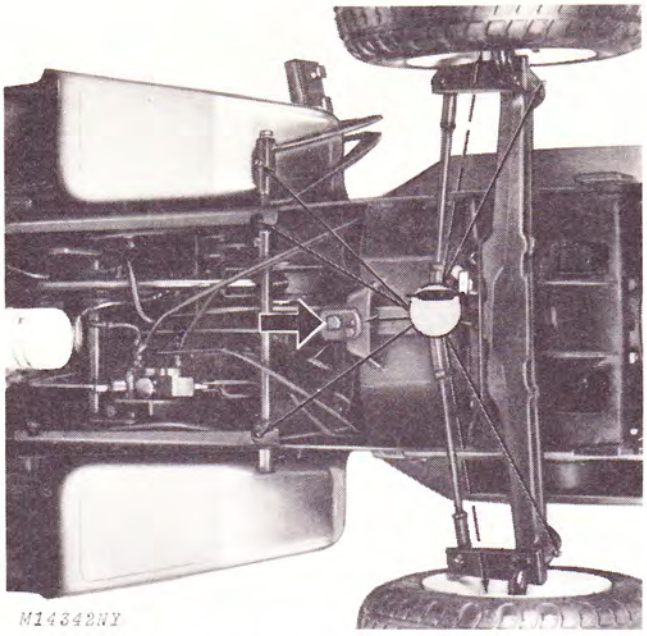

Fig. 9-Lubricating Front Wheels, Steering Pivot, Axle Spindles and Brake Pedal Shaft on 300, 312 and 316 Tractors (Serial No. 30,001-95,000)

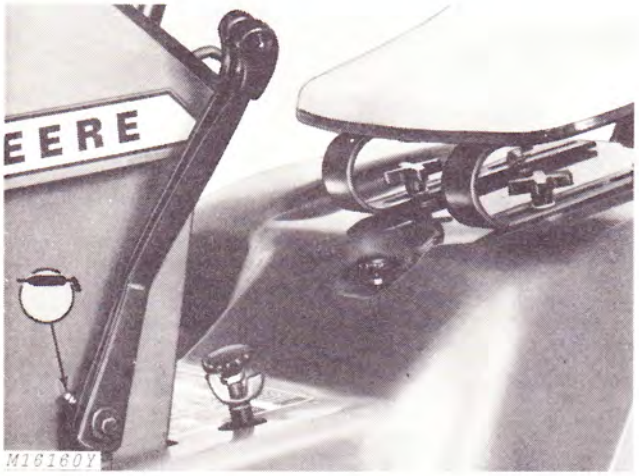

Fig. 10-Lubricating Hydraulic Lift Lever Shaft - 300 Tractors (Serial No. 30,001-80,000)

Lubricate fittings illustrated in Figs. 9, 10, 11, 12 and 13, using a John Deere Pisto-Luber or hand grease gun. Wipe fittings clean before and after lubrication.

Excessive play or difficult movement of the steering pivot on 300, 312 and 316 tractors (bold arrow), Fig. 9 may be the result of deteriorated Teflon washers at the pivot. If this occurs, remove Teflon washers, readjust pivot and lubricate.

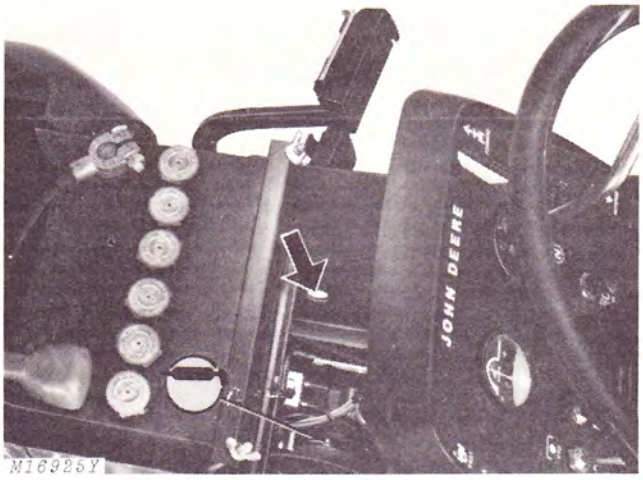

Fig. 11-Lubricating Steering Column - 300 Tractors (Serial No. 30,001-70,000)

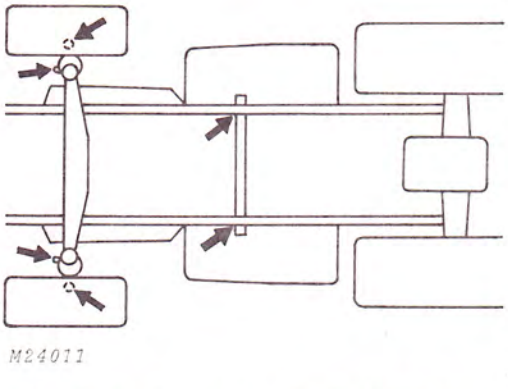

Fig. 12-Lubricating Front Wheels, Axle Spindles and Brake Pedal Shaft on 314 Tractors

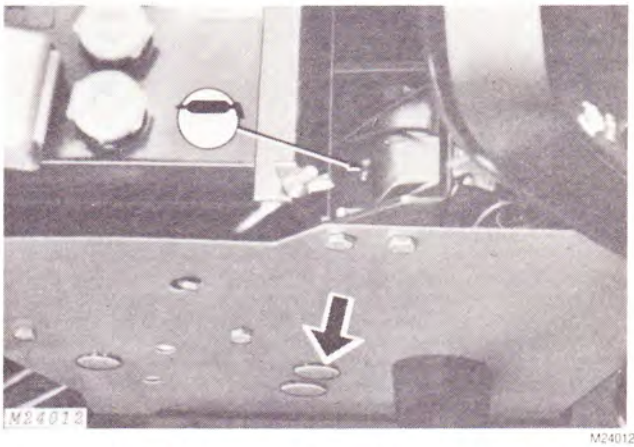

Fig. 13-Lubricating Steering Column Fitting on 314 Tractors

NOTE: To lubricate steering column fitting, Figs. 11 and 13, insert grease gun hose through hole in pedestal side panel. Do not overlubricate steering column fitting. Only 3 or 4 strokes are necessary. Do not use a high-pressure grease gun on this fitting.

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Group 20
TUNE-UP AND ADJUSTMENTS

PURPOSE OF INSTRUCTIONS

This group is intended to provide a service procedure for tractors that are running well. Minor repairs and adjustments made in an orderly fashion will improve the efficiency and operation of the engine and tractor.

Engine Tune-up

Engine tune-up involves checking, adjusting and servicing engine components — including the ignition system, air intake, fuel and lubrication systems.

Follow the procedures given below for complete engine tune-up.

Page

1. Clean Air Intake Screens and Cooling Fins 20-2
2. Test Compression 20-4
3. Check Spark Plug Gap 20-4
4. Test Crankcase Vacuum 20-5
5. Check Breaker Points 20-6
6. Adjust Breaker Points 20-6
7. Time Engine 20-7
8. Clean Air Cleaner Element 20-8
9. Adjust Carburetor 20-9
10. Adjust Anti-Dieseling Solenoid 20-9
11. Change Engine Oil 20-11
12. Service Battery 20-11
13. Install Grille, Hood and Side Panels 20-12

Tractor Adjustments

Tractor adjustments are made to assure that the engine horsepower will be utilized in the most efficient manner. A thorough, visual inspection of the complete tractor, as you make adjustments, will help in determining any extra service required on the tractor.

Make adjustments on tractor as follows:

Page

1. Check Transmission Fluid Level 20-13
2. Change Transmission Fluid and Filter 20-14
3. Lubricate Grease Fittings 20-15
4. Adjust Brakes 20-16
5. Adjust Hydrostatic Linkage 20-16
6. Check Hydraulic System Charge Pressure 20-17
7. Adjust Steering Gear 20-18
8. Adjust Steering Backlash 20-18
9. Adjust Front Wheel Toe-In 20-19
10. Clean Fuel Strainer 20-20
11. Check Wiring 20-20
12. Check Belts and Equipment 20-20
13. Check Tire Pressure 20-20

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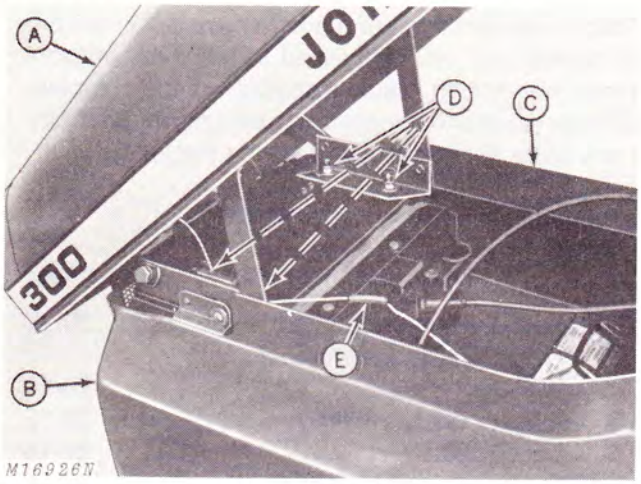
ENGINE TUNE-UP GUIDE

1. Clean Air Intake Screens and Cooling Fins

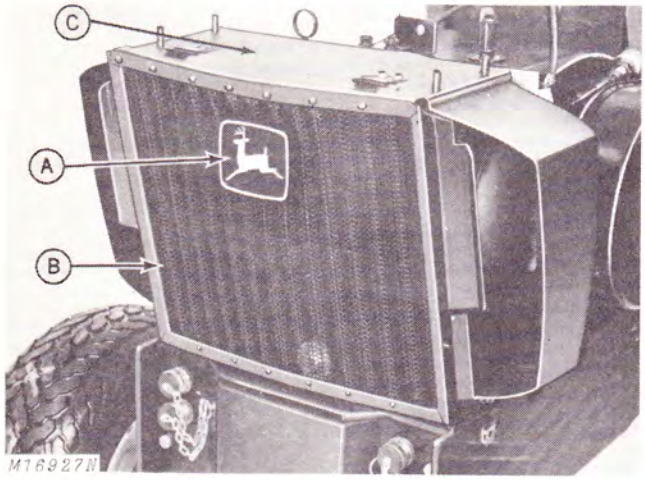
300 Tractors (Serial No. 30,001-80,000) and 314 and 316 Tractors



A—Hood
B—LH Side Panel
C—RH Side Panel
D—Nuts
E—Headlight Harness

Fig. 1-Removing Side Panels and Hood

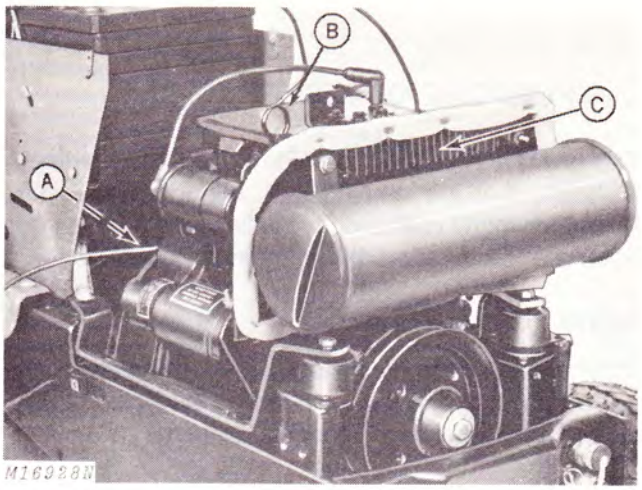
Tilt hood (A, Fig. 1), forward.
Remove left-hand side panel (B).
Remove right-hand side panel (C).
Disconnect headlight harness (E).
Remove four nuts (D) on 300 and 316 Tractors. Remove four bolts on 314 Tractor. Lift hood (A) from tractor.



A—Grille Emblem **B—Grille** **C—Hood Support**

Fig. 2-Removing Grille and Hood Support

Place your hand under emblem (A), and pull out to remove grille (B, Fig. 2).
Remove hood support (C).



A—Air Intake Screen **B—Head Baffle** **C—Cooling Fins**

Fig. 3-Cleaning Engine

Remove dirt and foreign material from air intake screen (A, Fig. 3).

Remove engine head baffle (B).

Brush dirt from engine cooling fins (C).

Clean off oil deposits with a safe solvent.

Install engine head baffle (B).

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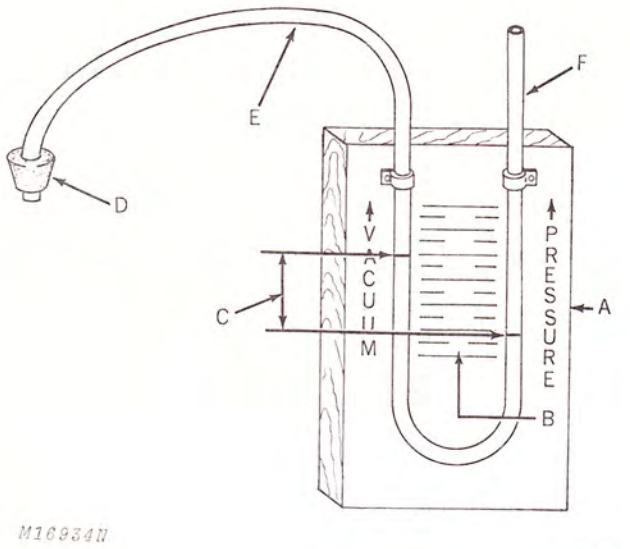
4. Test Crankcase Vacuum



A—Manometer
B—Scale in Inches
C—Difference Between Columns
D—Stopper
E—Clear Tube
F—Open to Atmosphere

Fig. 8-Checking Crankcase Vacuum

Remove dipstick.

NOTE: Follow manufacturer's recommendations for installation, testing and allowing for the effect of altitude on the gauge reading.

Install stopper (D, Fig. 8) in oil filler tube.

Start engine and allow it to warm up.

Hang U-tube manometer (A) vertically.

Crankcase vacuum should read 5 to 10-inch water column (C).

Always remove manometer before stopping engine.

A low crankcase vacuum reading is most likely due to a clogged breather valve or improperly assembled breather. A low reading may also be caused by leaking valves, engine blow-by or worn oil seals.

If the crankcase is found to be pressurized rather than have a vacuum, the breather filter is most likely plugged.

Engines with zero vacuum or pressurized crankcase will probably pump oil into the combustion chamber or out the breather or oil seals. This can be detected by watching for excessive exhaust smoke, engine overheating or oil leakage outside the engine.

5. Check Breaker Points

Fig. 9-Checking Breaker Points

Remove breaker cover.

Check condition of breaker points, Fig. 9. Replace badly burned or pitted breaker points. If slightly pitted points have been dressed down with a point file as a temporary field fix, replace the points. If points are oxidized, rub a piece of coarse cloth across surfaces. Clean dirty or oily points with cloth, but make sure no particles of lint are left between surfaces.

To replace points, remove screws, Fig. 9. Be sure lock washers are in place when installing new points.

Adjust points, Fig. 10.

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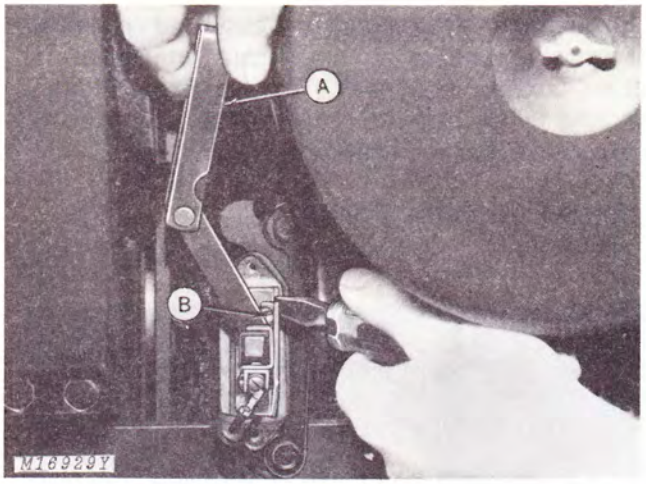
6. Adjust Breaker Points



A—Feeler Gauge **B—Adjusting Screw**

Fig. 10-Adjusting Breaker Points

Remove breaker point cover.

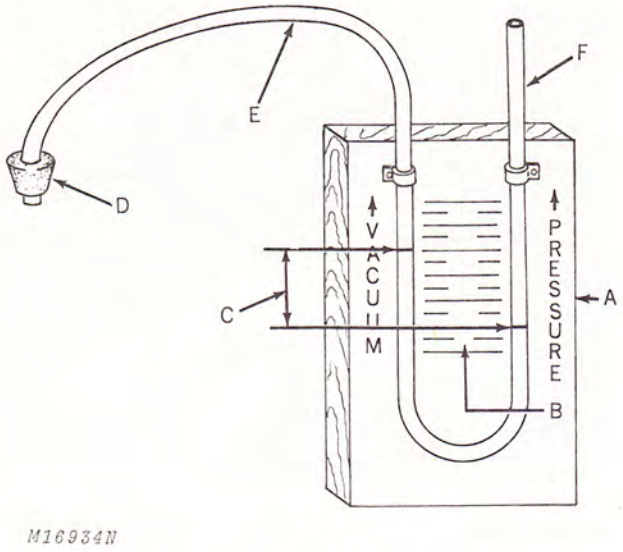
Remove spark plug lead to prevent unintentional starting.

Rotate engine by hand in direction of normal rotation (clockwise when viewed from flywheel end). Points should just begin to open as the "S" mark appears in the center of the timing sight hole (B, Fig. 11).

Continue rotating engine until points reach maximum opening. Measure gap with feeler gauge (A, Fig. 10). Gap should be 0.020 inch (0.508 mm) when fully open.

If necessary, loosen point gap adjusting screw (B) and adjust gap to 0.020 inch (0.508 mm). Maximum gap setting can vary from 0.018 inch (0.457 mm) to 0.022 inch (0.558 mm) to achieve smoothest running. Securely tighten adjusting screw (B) after timing.

4. Test Crankcase Vacuum



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A—Manometer
B—Scale in Inches
C—Difference Between Columns
D—Stopper
E—Clear Tube
F—Open to Atmosphere

Fig. 8-Checking Crankcase Vacuum

Remove dipstick.

NOTE: Follow manufacturer's recommendations for installation, testing and allowing for the effect of altitude on the gauge reading.

Start engine and allow it to warm up.

Hang U-tube manometer (A) vertically.

Install stopper (D) in oil filler tube.

Crankcase vacuum should read 5 to 10-inch water column (C).

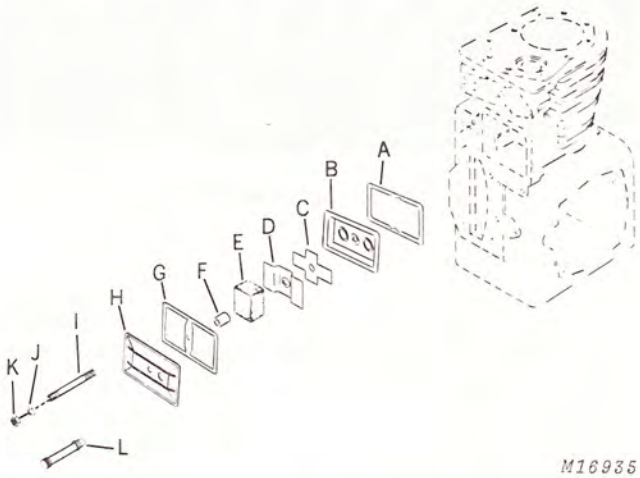
Always remove manometer before stopping engine.

A low crankcase vacuum reading is most likely due to a clogged breather valve or improperly assembled breather. A low reading may also be caused by leaking valves, engine blow-by or worn oil seals.

If the crankcase is found to be pressurized rather than have a vacuum, the breather filter is most likely plugged.

Engines with zero vacuum or pressurized crankcase will probably pump oil into the combustion chamber or out the breather or oil seals. This can be detected by watching for excessive exhaust smoke, engine overheating or oil leakage outside the engine.

5. Clean Crankcase Breather



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A—Gasket
B—Plate
C—Reed
D—Baffle
E—Filter
F—Spacer
G—Gasket
H—Cover
I —Stud
J —Lock Washer
K—Nut
L—Hose (300 and 316 Tractor Only)

Fig. 9-Cleaning Crankcase Breather

Remove breather assembly, Fig. 9.

Clean filter (E). Replace filter if it is extremely dirty.

Install new gaskets (A and G) whenever breather has been removed.

Reassemble and install breather exactly as shown, Fig. 9.

NOTE: Make sure small hole at bottom of plate (B) is down. If plate is reversed, engine will pump oil out of the breather chamber which will result in engine damage.

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6. Check Breaker Points

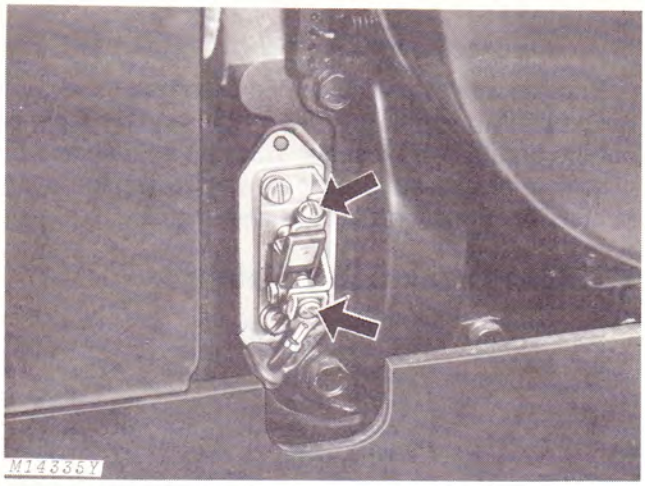


Fig. 10-Checking Breaker Points

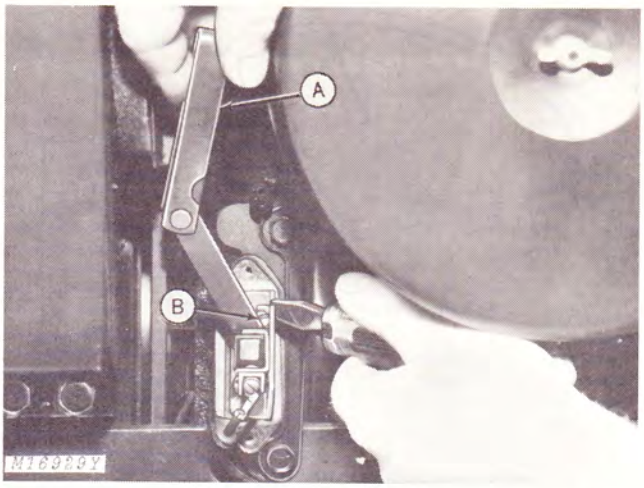
Remove breaker cover.

Check condition of breaker points, Fig. 10. Replace badly burned or pitted breaker points. If slightly pitted points have been dressed down with a point file as a temporary field fix, replace the points. If points are oxidized, rub a piece of coarse cloth across surfaces. Clean dirty or oily points with cloth, but make sure no particles of lint are left between surfaces.

To replace points, remove screws, Fig. 10. Be sure lock washers are in place when installing new points.

Adjust points, Fig. 11.

7. Adjust Breaker Points



A—Feeler Gauge **B—Adjusting Screw**

Fig. 11-Adjusting Breaker Points

Remove breaker point cover.

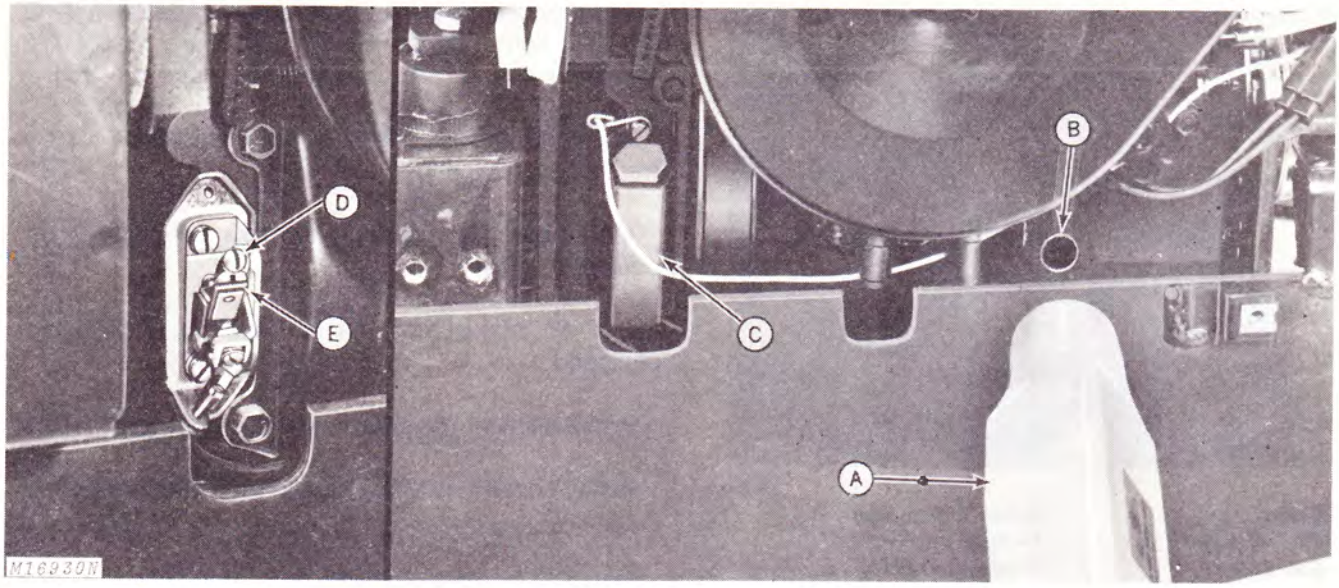
Remove spark plug lead to prevent unintentional starting.

Rotate engine by hand in direction of normal rotation (clockwise when viewed from flywheel end). Points should just begin to open as the "S" mark appears in the center of the timing sight hole (B, Fig. 12).

Continue rotating engine until points reach maximum opening. Measure gap with feeler gauge (A). Gap should be 0.020 inch (0.508 mm) when fully open, Fig. 11.

If necessary, loosen point gap adjusting screw (B) and adjust gap to 0.020 inch (0.508 mm). Maximum gap setting can vary from 0.018 inch (0.457 mm) to 0.022 inch (0.558 mm) to achieve smoothest running. Securely tighten adjusting screw (B) after timing.

7. Time Engine (With Timing Light)



A—Timing Light **B—Timing Sight Hole** **C—Breaker Point Cover** **D—Gap Adjusting Screw** **E—Breaker Plate**

Fig. 11-Timing Engine with a Timing Light

Several different types of timing lights are available. Follow manufacturer's instructions for the type used. The following timing procedure can be used with most timing lights.

Remove high tension lead at spark plug. Wrap one end of a short piece of fine wire around spark plug terminal. Reconnect lead to terminal. Free end of wire must protrude from under boot.

NOTE: Some lights have a sharp probe on the spark lead. With these, simply push probe thru boot until it contacts metal connector.

Connect one timing light lead to the wire wrapped around spark plug terminal.

Connect second timing light lead to positive side of battery. See timing light instructions for battery size, wiring, etc.

Connect third timing light lead to ground.

CAUTION: Disconnect lead at terminal before rotating engine.

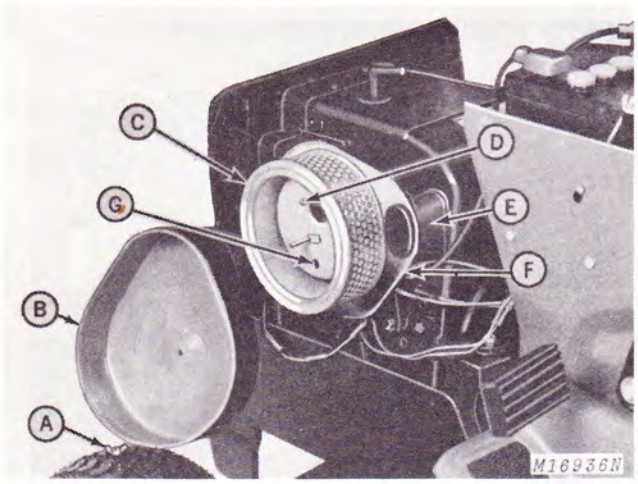
Rotate engine by hand until "S" mark is visible through sight hole (B, Fig. 11). Chalk "S" line for easy reading.

The engine is equipped with a timing sight hole in the blower housing, Fig. 11. Two timing marks are stamped on the flywheel. The "T" mark indicates top dead center (TDC). The "S" mark indicates the spark point, which is 20 degrees before top dead center.

Start and run engine at 1200 to 1800 rpm. Aim timing light (A) into sight hole (B). The light should flash just as "S" mark is centered in sight hole of blower housing.

If timing is off, remove breaker point cover (C), loosen gap adjusting screw (D), and shift breaker plate (E) until "S" mark is exactly centered in sight hole when timing light flashes. Retighten adjusting screw before replacing breaker point cover.

8. Clean Air Cleaner Element



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A—Cover
B—Filter Element
C—Cap Screws
D—Air Intake Tube
E—Base
F—Breather Hose

Fig. 12-Cleaning Air Cleaner (300 Tractor Illustrated)

Remove wing nut, cover (A, Fig. 12) and filter element (B).

Tap element lightly to shake out dust. Use a soft brush to remove foreign materials.

IMPORTANT: Never use a liquid cleaner or compressed air to clean element. Replace element if it is damaged or extremely dirty.

Wipe dirt from cover.

NOTE: On 300, 314, 316 and late model 312 Tractors, remove air cleaner base (E) and adjust carburetor, page 10-20-9, before reinstalling element. Early model 312 Tractors were not equipped with air intake tube (D).

Install air cleaner base (E) and cap screws (C) on tractors so equipped.

Install breather hose (F) in base on tractors so equipped.

Install air intake tube (D) in base on tractors so equipped.

Install element (B) around air cleaner base (E).

Install cover (A). Make sure cover seal is properly seated.

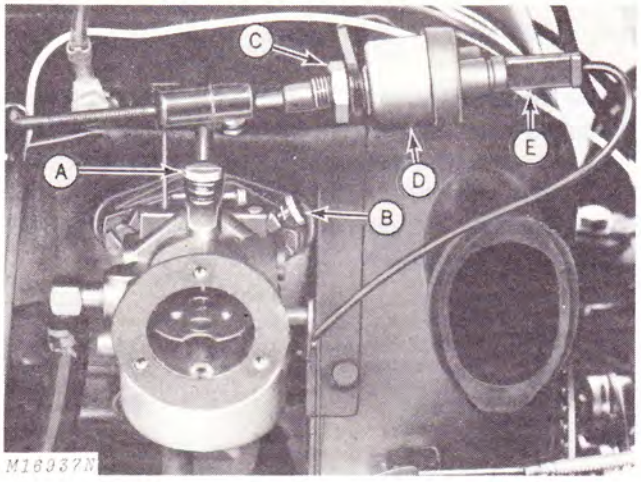
Install wing nut finger-tight.

9. Adjust Carburetor

300 And 316 Tractors

Initial Adjustment

Turn high-speed mixture screw (A, Fig. 13) clockwise until closed. Close finger tight only. Then open 1½ turns (counterclockwise). Turn idle mixture screw (B) clockwise until closed. Close finger tight only. Then open ½ turn (counterclockwise). This initial adjustment will permit the engine to be started and warmed up before making final adjustment.



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A—High-Speed Mixture Screw
B—Idle Mixture Screw
C—Jam Nut
D—Anti-Dieseling Solenoid
E—Connector

Fig. 13-Adjusting 300 and 316 Tractor Carburetor

Final Adjustment

Start engine and run with throttle lever in the "FAST" position (3400 to 3500 rpm). Allow engine to warm up.

IMPORTANT: Be sure choke knob is pushed all the way in after engine is warmed up.

Turn high-speed mixture screw (A, Fig. 13) clockwise until engine starts to lose speed (lean mixture). Then slowly turn high-speed mixture screw counterclockwise past the point of smoothest operation until engine just begins to run rough. This mixture should be best for performance under load.

Move throttle lever to "SLOW" position (2000 to 2200 rpm). Turn idle mixture screw (B) clockwise or counterclockwise until engine idles smoothly.

Raise throttle lever quickly to check for smooth acceleration. If engine misses, fuel-air mixture is too lean. Turn high-speed mixture screw (A) counterclockwise until positive acceleration is obtained. If excess exhaust smoke is noticed, fuel-air mixture is too rich. Readjust idle mixture screw (B) until good balance is achieved and engine runs smoothly.

10. Adjust Anti-Dieseling Solenoid

Check engine for correct idle speed with a vibration tachometer (2000 to 2200 rpm).

If engine idle speed is incorrect, shut off tractor. Disconnect connector (E). Loosen jam nut (C). Turn anti-dieseling solenoid (D) away from carburetor to reduce idle speed or toward carburetor to increase idle speed.

Install connector (E), start tractor and check idle speed. Repeat adjustment procedure until correct idle speed is attained. Tighten jam nut (C) to secure solenoid in place after correct idle speed is attained.

Install air cleaner, Fig. 12.

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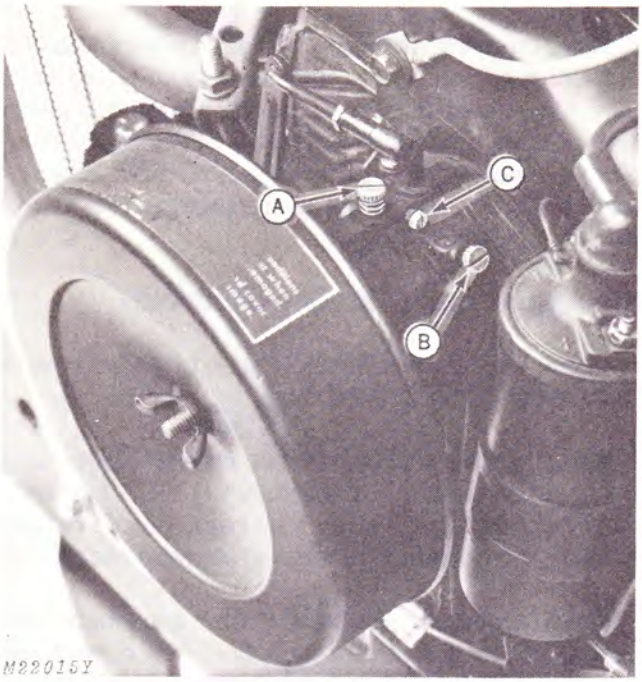
312 and 314 Tractors



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A—High-Speed Mixture Needle
B—Idle Mixture Needle
C—Idle Speed Screw

Fig. 14-Adjusting Carburetor (312 Tractor Illustrated)

NOTE: Idle adjustment and high-speed adjustment must be made at the same time as each affects the other. Adjust as follows:

1. Turn high-speed mixture needle (A, Fig. 14) clockwise until closed. Close finger-tight only. Then open 2 turns.

2. Turn idle mixture needle (B) clockwise until closed. Close finger-tight only. Then open ½ turns.

3. Start engine and raise throttle lever to "FAST" position. Allow engine to warm up.

4. Turn high-speed mixture needle (A) ⅛ turn each time, clockwise or counterclockwise, until engine runs smoothly at full throttle. Keep needle positioned slightly on the rich side (open) when operating with power-driven equipment such as the mower.

5. Move throttle lever to "SLOW" position and turn idle mixture needle (B) ⅛ turn each time, clockwise or counterclockwise until engine idles smoothly.

6. Advance throttle lever quickly to check for uniform acceleration. If engine misses, gas-air mixture is too lean. Turn high-speed mixture needle (A) counterclockwise until positive acceleration is attained.

If excess exhaust smoke is noticed, mixture is too rich. Readjust idle mixture needle (B), if necessary, until good balance is achieved and engine idles smoothly between 2000 and 2200 rpm for 314 Tractor and 2400 rpm ± 100 rpm for 312 Tractor.

The idle speed screw (C) adjusts the speed at which the engine idles. Turn idle speed screw in to increase idle speed or out to decrease idle speed. Check for correct idle speed with a vibration tachometer. Proper idle speed on the 312 engine is 2400 rpm ± 100 rpm. Idle speed on 314 engine is 2000 to 2200 rpm.

Litho in U.S.A.

11. Change Engine Oil

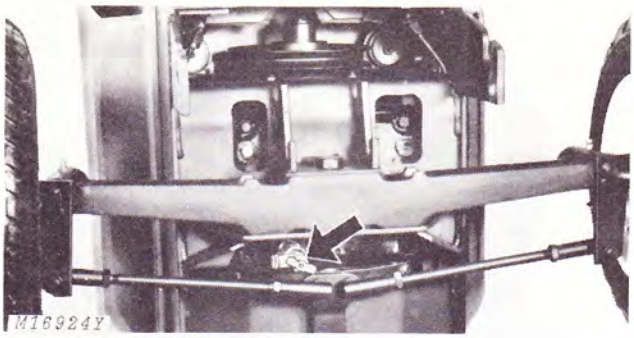


Fig. 15-Draining Engine Oil - 300 Tractors (Serial No. 30,001-55,000)

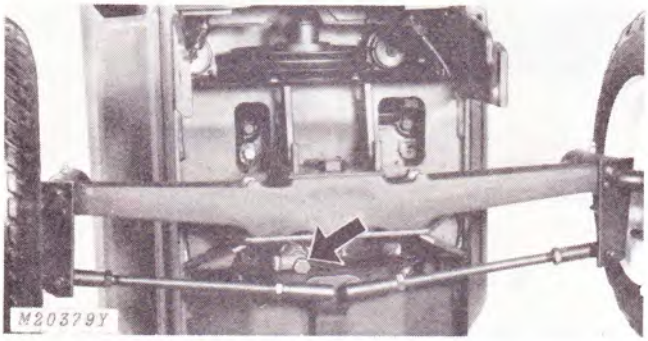


Fig. 16-Draining Engine Oil - 300 Tractors (Serial No. 55,001-80,000) and 316 Tractors

IMPORTANT: Drain crankcase when oil is hot and all dirt and foreign material is in suspension.

Turn oil drain valve (arrow) counterclockwise to open, Fig. 15, 300 Tractors (Serial No. 30,001-55,000) or Fig. 16, 300 Tractors (Serial No. 55,001-80,000) and 316 Tractors.

NOTE: Remove oil drain plug (not illustrated) from bottom of crankcase on 312 and 314 Tractors.

IMPORTANT: On 300 Tractors (Serial No. 55,001-80,000), and 316 Tractors, use a hex. head wrench to loosen or open valve. When closing valve, do not use a wrench to tighten. Hand tighten only.

NOTE: For convenience on 300 and 316 Tractors, a suitable length of ⅝ inch (15.88 mm) hose or plastic tubing may be installed on drain valve to allow oil to drain into a container away from the tractor.

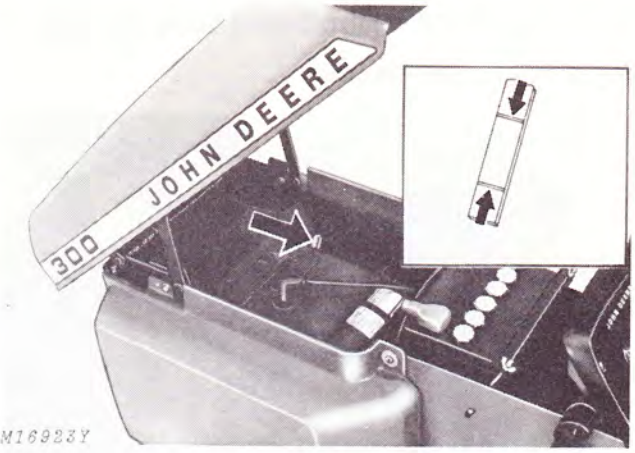


Fig. 17-Filling Crankcase

Remove dipstick, Fig. 17.

Fill crankcase with oil of the proper viscosity (see chart on page 10-15-1) to midpoint of two arrows on dipstick. Crankcase capacity is approximately 3 pints (1.419 l).

IMPORTANT: Check dipstick reading before pouring in last ½ pint (0.2366 l). Fill only to midpoint of two arrow marks. The oil level should never be over the top arrow mark. Overfilling can cause engine overheating resulting in loss of power and permanent damage to engine.

12. Service Battery

Clean battery.

Inspect cables.

Clean terminals.

Inspect battery tray and hold-down.

Inspect battery case for cracks or leaks.

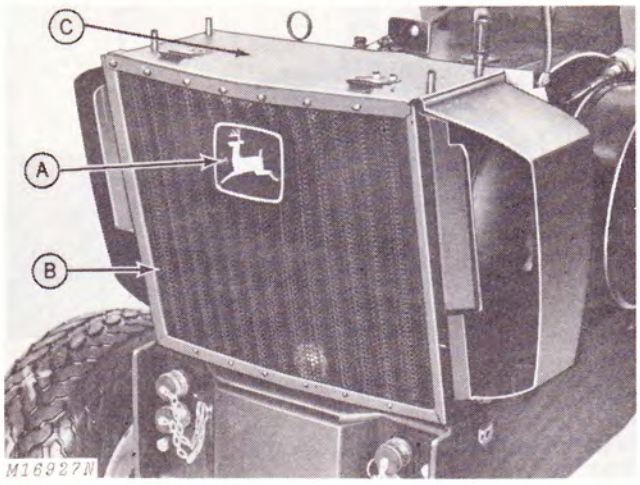
Make hydrometer test, see page 40-10-7.

Add water if necessary.

Recharge battery if less than 75% charged.

13. Install Grille, Hood and Side Panels

300, 314 And 316 Tractors



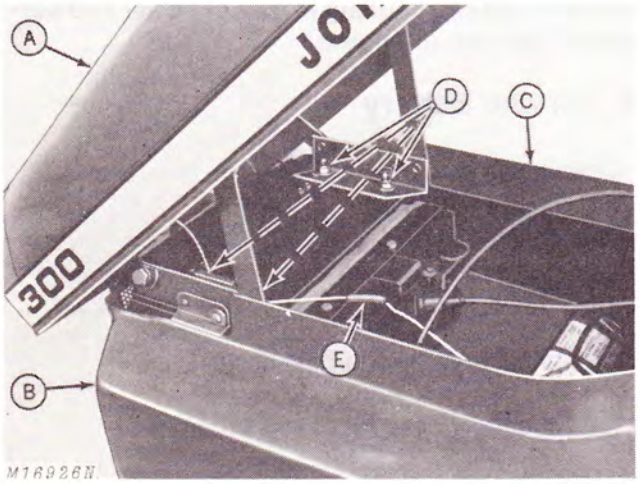
A—Grille Emblem **B—Grille** **C—Hood Support**

Fig. 18-Installing Grille and Hood Support (300 Tractor Illustrated)

Place hood support (C) on tractor frame, Fig. 18.

Install four hood support screws. Tighten screws.

Push grille (B) onto hood support (C) until grille clips hold grille in place.



A—Hood
B—LH Side Panel
C—RH Side Panel
D—Nuts
E—Headlight Harness

Fig. 19-Installing Hood and Side Panels

Install hood (A), Fig. 19, over studs on hood support.

Install four nuts (D) on 300 and 316 Tractors. Install four bolts on 314 Tractor.

Connect headlight harness (E).

Install left-hand side panel (B).

Install right-hand side panel (C).

Lower hood (A).

A—Hood
B—Grille
C—Hood Support
D—Cap Screws

Fig. 20-Install Hood, Grille, and Hood Support

Bolt hood support (C, Fig. 20) with hood (A) as an assembly to tractor frame with four cap screws (D).

Install grille (B).

TRACTOR ADJUSTMENT GUIDE

1. Check Transmission Fluid Level

300 Tractors (Serial No. 30,001-71,160)

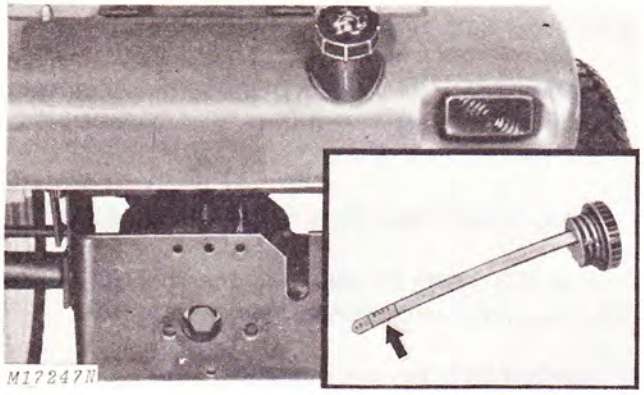


Fig. 21-Checking Transmission Fluid Level - 300 Tractors (Serial No. 30,001-71,160)

IMPORTANT: Check transmission fluid level when fluid is warm. Park tractor on a level surface with hydrostatic control lever in "neutral". Set parking brake and stop engine. Never allow dirt to enter hydraulic system.

Tighten dipstick to insure correct reading; then, remove it.

Fluid level should be at midpoint of "SAFE" range, Fig. 21. On tractors equipped with 3-point hitch or rear PTO drive, the fluid level should be at top of point on the dipstick, Fig. 22.

If required, add John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" Automotive Automatic Transmission Fluid. Do not overfill.

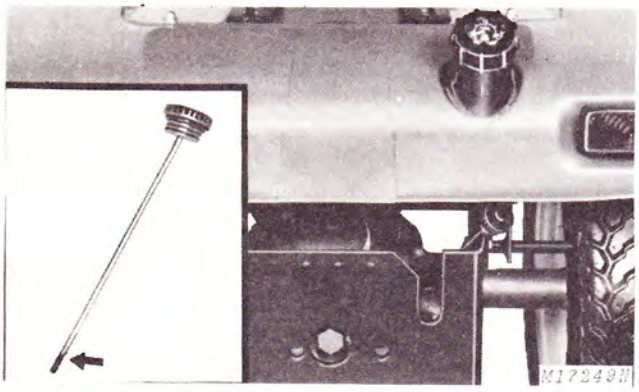
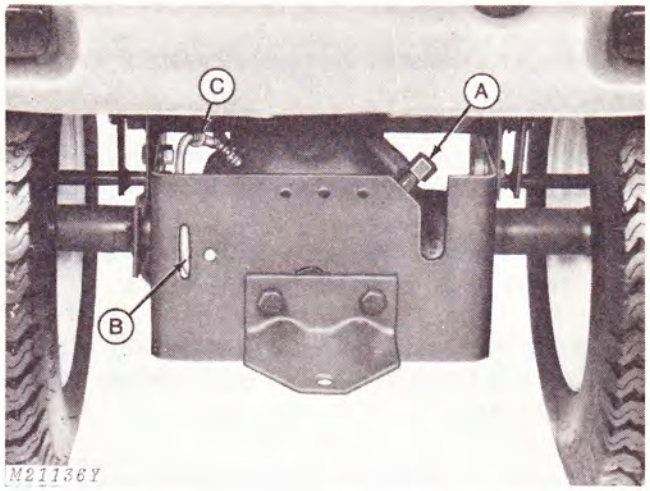


Fig. 22-Checking Transmission Fluid Level (300 Tractors Equipped with 3-Point Hitch or Rear PTO Drive) (Serial No. 30,001-71,160)

300 Tractors (Serial No. 71,161-80,000), 312, 314 and 316 Tractors



A—Fill Tube Cap
B—Sight Tube
C—Accumulator Vent

Fig. 23-Checking Transmission Fluid Level - 300 Tractors (Serial No. 77,161-80,000) and 312, 314 and 316 Tractors

NOTE: The tractor engine should not be running when checking or adding fluid.

Fluid level in sight tube (B, Fig. 23) should be ¼ to 1¼ inches (5 to 30 mm) above bottom of slot in frame when tractor engine is stopped.

IMPORTANT: The 1/16 inch diameter hole in outside wall of accumulator-vent (C) must be positioned at an upward angle to prevent fluid leakage and insure proper venting.

If fluid level is low, remove fill tube cap (A) and add necessary amount of fluid until it is ¼ to1¼ inches (5 to 30 mm) above bottom of slot in frame.

IMPORTANT: Do not overfill.

Litho in U.S.A.

2. Change Transmission Fluid and Filter

Change filter every 100 hours of operation.

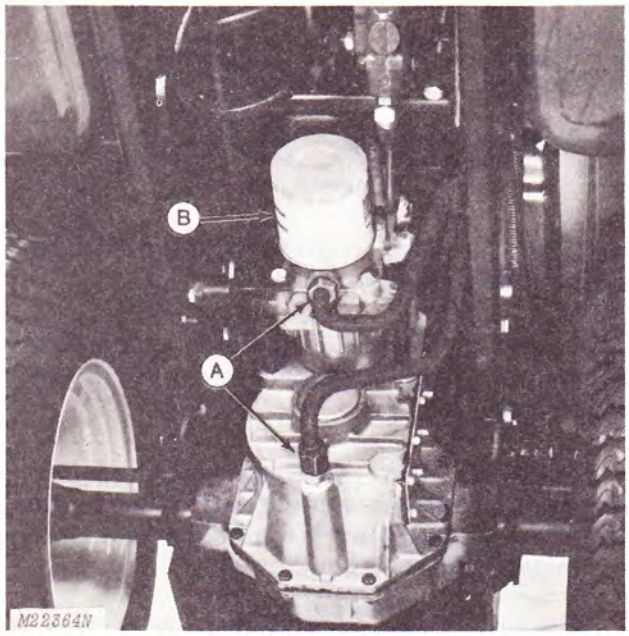
NOTE: It is not necessary to completely drain fluid if only the filter is being changed.

Change transmission fluid every 2 years or 500 hours of operation.

Park tractor on a slight incline to completely drain the transmission. Stop engine and set the parking brake.

On 300 Tractors (Serial No. 30,001-71,160) remove the dipstick, Figs. 21 or 22, page 10-20-13.

On 300 Tractors (Serial No. 71,161-80,000) and 312, 314 and 316 Tractors, remove the fill tube cap, Fig. 23, page 10-20-13.



A—Transmission-to-Axle Cooling Tube **B—Filter**

Fig. 24-Changing Transmission Fluid and Filter

IMPORTANT: Never allow dirt to enter hydraulic system. Clean dirt from filter (B, Fig. 24), dipstick cap and transmission-to-axle cooling tube (A) before removing them.

Remove transmission-to-axle cooling tube (A). Drain fluid into a container and replace transmission-to-axle cooling tube.

Remove filter (B). Fill new filter half-full of transmission fluid. Moisten rubber filter gasket with fluid. Install filter finger-tight only.

Fill transmission with John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" Automotive Automatic Transmission Fluid.

Transmission capacity is 5 U.S. quarts (4.731 l).

Pour in 3 quarts (2.839 l) only, then check transmission fluid level as explained on page 10-20-13.

IMPORTANT: Do not overfill.

Add necessary amount of fluid to fill transmission.

3. Lubricate Grease Fittings

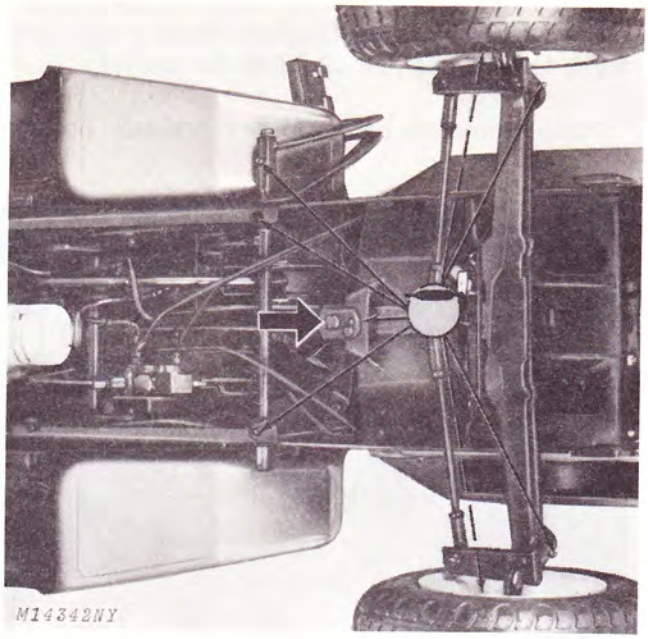


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Fig. 25-Lubricating Front Wheels, Steering Pivot, Axle Spindles and Brake Pedal Shaft on 300, 312 and 316 Tractors (Serial No. 30,001-95,000)

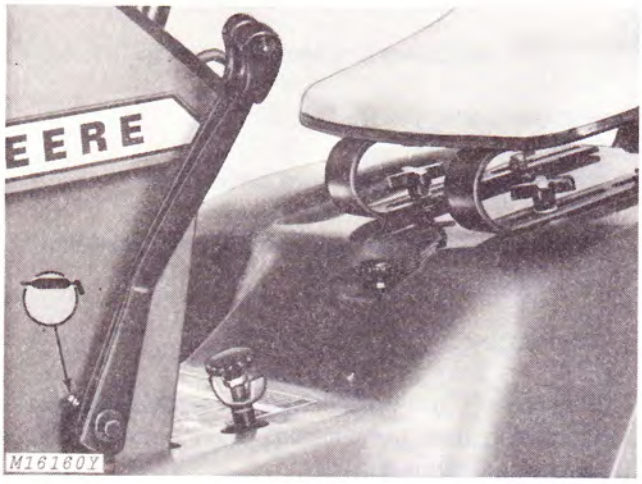

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Fig. 26-Lubricating Hydraulic Lift Lever Shaft-300 Tractors (Serial No. 30,001-80,000)

Lubricate fittings illustrated in Figs. 25, 26, 27, 28 and 29, using a John Deere Pisto-Luber or hand grease gun. Wipe fittings clean before and after lubrication.

Excessive play or difficult movement of the steering pivot on 300, 312 and 316 tractors (bold arrow), Fig. 25, may be the result of deteriorated teflon washers at the pivot. If this occurs, remove teflon washers, readjust pivot and lubricate.

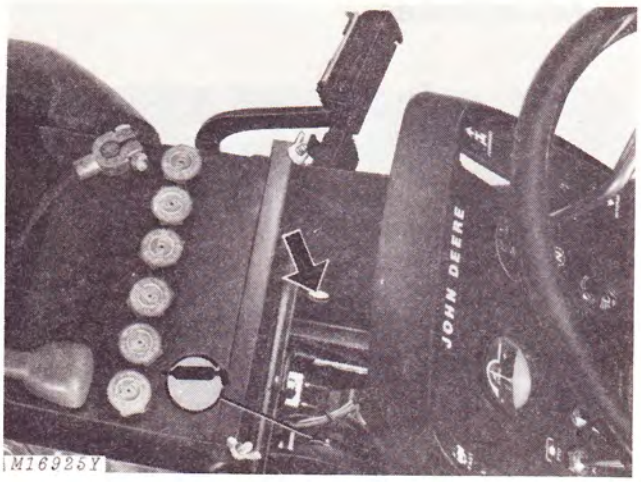

Fig. 27-Lubricating Steering Column

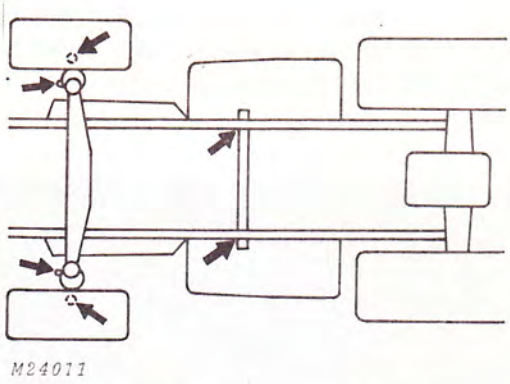

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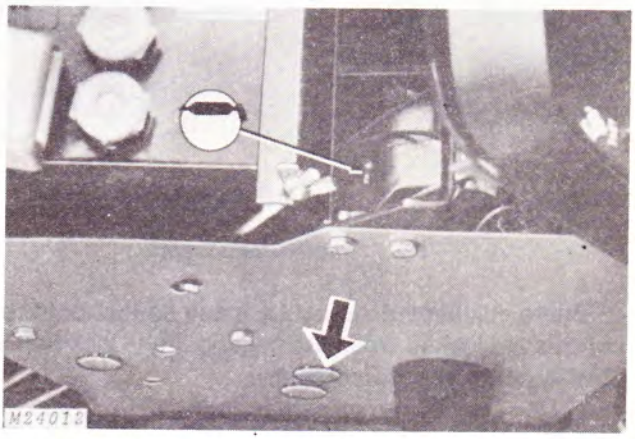
Fig. 28-Lubricating Front Wheels, Axle Spindles and Brake Pedal Shaft on 314 Tractor



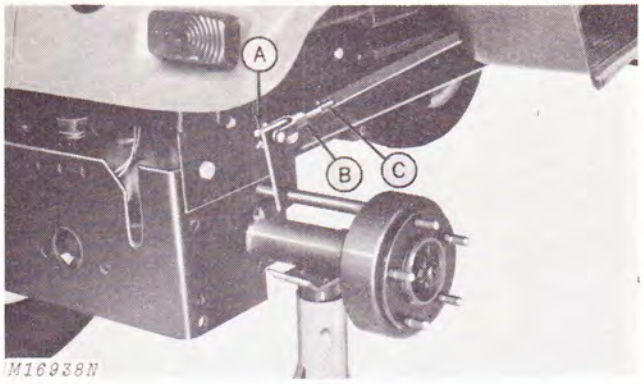
M24012

Fig. 29-Lubricating Steering Column Fitting on 314 Tractor

NOTE: To lubricate steering column fitting, Figs. 27 and 29, insert grease gun hose through hole in pedestal side panel. Do not overlubricate steering column fitting. Only 3 or 4 strokes are necessary. Do not use a high-pressure grease gun on this fitting.

Litho in U.S.A.

4. Adjust Brakes

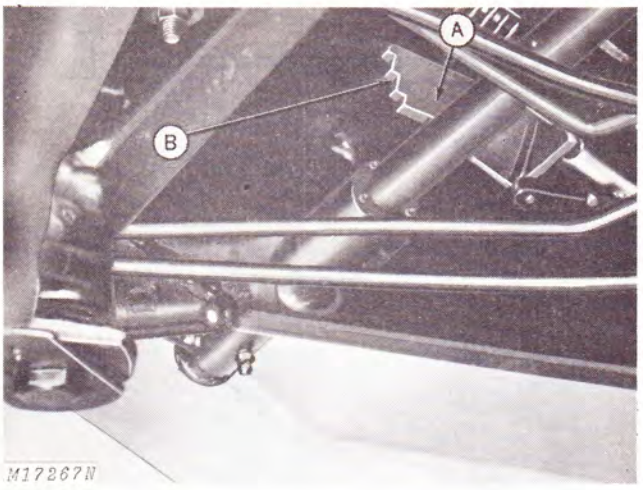


M16938N

A—Pin **B—Yoke** **C—Link**

Fig. 30-Adjusting Brakes

To adjust brakes, remove pin (A, Fig. 30), on both sides of tractor. Turn yokes (B) onto brake links (C) equally to tighten brakes or off brake links to loosen brakes.



M17267

A—Brake Lock **B—Second Notch**

Fig. 31-Parking Brake Lock

Brake adjustment should be made so that both rear wheels are locked when the parking brake lock (A, Fig. 31), is in the second notch (B).

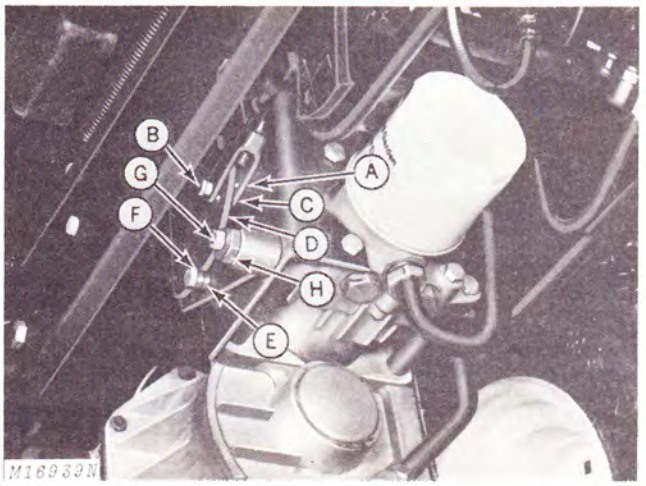
A final check should be made. On 300 and 316 Tractors, lock the brake pedals together with the locking strap. Lower the parking brake knob. Depress pedals until the brake engages in the second notch of the parking brake lock. On 312 Tractors, lower parking brake knob and depress brake pedal until brakes engage in second notch of parking brake lock.

Both rear wheels should be locked. If not, readjust brakes as illustrated in Fig. 30.

5. Adjust Hydrostatic Linkage

Park tractor on a level surface. Place a jack under frame to raise one rear wheel off the ground.

Place hydrostatic control lever in "neutral" position.



M16939N

A—Cotter Pin **E—Roller**
B—Drilled Pin **F—Detent**
C—Clevis **G—Nut**
D—Control Cam **H—Eccentric**

Fig. 32-Adjusting Hydrostatic Linkage

Remove cotter pin (A, Fig. 32).

Remove drilled pin (B) from clevis (C).

Move control cam (D) until roller (E) seats in detent (F) on control cam.

Start engine.

Loosen nut (G). Turn eccentric (H) clockwise or counterclockwise until transmission is in neutral position (raised wheel stops turning).

Stop engine.

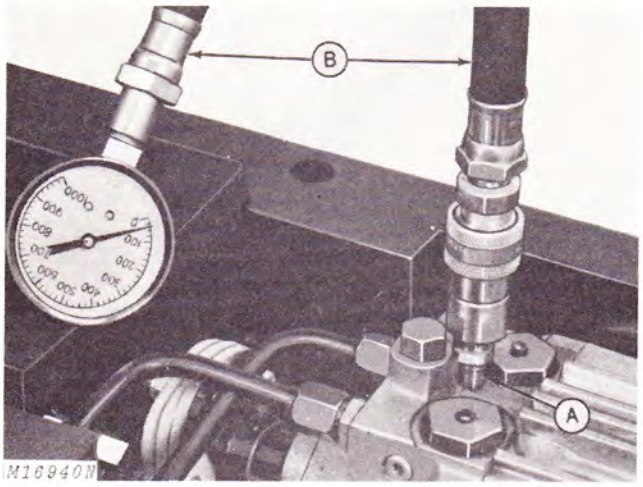
Turn clevis (C) on or off control rod until clevis aligns with hole in control cam (D).

Install drilled pin (B) through clevis (C) and control cam (D).

Install cotter pin (A) in drilled pin (B).

6. Check Hydraulic System Charge Pressure

Remove fender-deck, fuel tank (refer to Section 30, page 20-2) and fan shield.



M16940N

A—⅛ inch Pipe Adapter **B—Pressure Gauge**

Fig. 33-Checking Charge Pump Pressure

Remove pipe plug from top of transmission.

Install a ⅛ inch pipe adapter (A, Fig. 33) in pipe plug hole.

Install a JDST-5 Pressure Gauge (B).

CAUTION: Keep hands and tools away from transmission fan when operating tractor with fender-deck and fan shield removed.

Start and run engine at half-throttle with hydrostatic lever in "neutral" position.

Pressure gauge should read between 70 and 110 psi (480 to 750 kPa).

A lower pressure reading indicates the following:

Low oil level.

Plugged oil filter.

Improperly functioning charge pressure relief valve.

Worn charge pump.

Excessive internal leakage in the transmission caused by worn pistons and slippers.

Shut off engine.

CAUTION: Make sure pressure gauge needle has returned to "0".

Remove pressure gauge and pipe adapter. Install pipe plug. Replace fan shield, fuel tank and fender-deck.

M16941N

Fig. 34-Charging Implement Circuit Pressure on Tractors Equipped with Front Hydraulic Outlets

On 300 and 316 Tractors, and 312 and 314 Tractors equipped with front hydraulic outlets (extra equipment), install a JDST-5 Pressure Gauge in top left-hand front hydraulic outlet, Fig. 34.

Start and run engine at full throttle.

Move outer hydraulic control lever forward.

Pressure gauge should read 500 to 600 psi (3447 to 4136 kPa).

A lower pressure reading indicates the following:

Low oil level.

Plugged oil filter.

Improperly functioning implement pressure relief valve.

Worn charge pump.

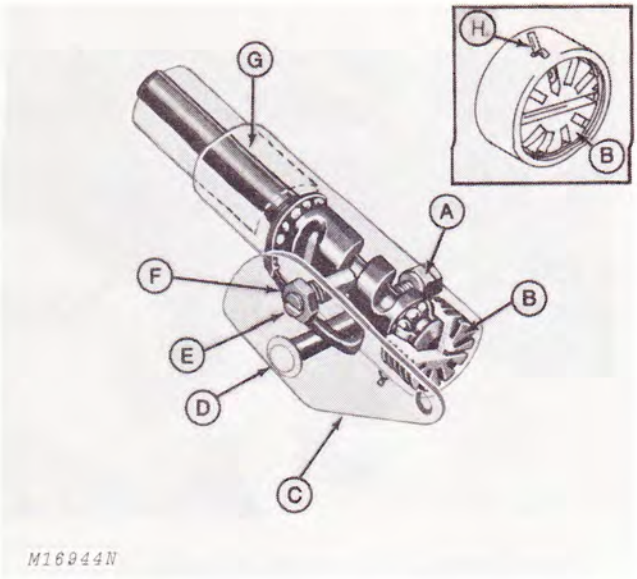
Excessive internal leakage in the transmission caused by worn pistons and slippers.

Shut off engine. Move outer control lever rearward to relieve pressure.

CAUTION: Make sure pressure gauge needle has returned to "0".

Remove pressure gauge.

7. Adjust Steering Gear



M16944N

A—Jam Nuts
B—Adjusting Plug
C—Lever Arm
D—Cross Bolt
E—Tapered Stud
F—Lock Nut
G—Housing
H—Cotter Pin

Fig. 35-Adjusting Bearings

Disconnect steering linkage (not illustrated) from lever arm (C, Fig. 35).

Loosen jam nuts (A) on cross bolt (D).

Loosen lock nut (F) and tapered stud (E) several turns.

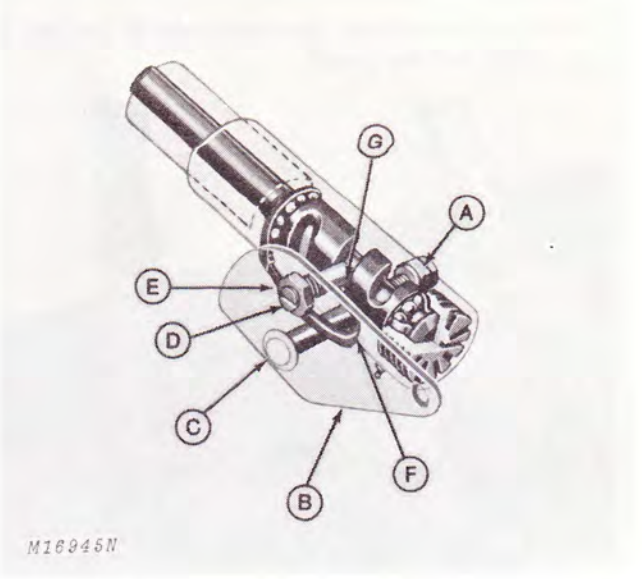
Remove cotter pin (H) from adjusting plug (B).

Turn adjusting plug (B) into housing (G). Tighten to 10 to 14 ft-lbs (13 to 19 Nm) torque.

Install cotter pin (H) as shown.

NOTE: Connect steering linkage to lever arm (C) after backlash adjustment has been accomplished.

8. Adjust Steering Backlash



M16945N

A—Jam Nuts
B—Lever Arm
C—Cross Bolt
D—Tapered Stud
E—Lock Nut
F—Housing Face
G—Mid-Point on Gear

Fig. 36-Adjusting Backlash

Adjust the steering gear so there is a slight drag at mid-point on gear (G, Fig. 36), as the steering wheel is turned through its full range of travel.

To find mid-point on gear (G), count the number of turns from one extreme to the other.

Turn steering wheel one-half the total number of turns. Adjust at this point.

To adjust steering backlash, place a 0.100 inch (2.54 mm) thick spacer between lever arm (B) and housing face (F).

Tighten inside jam nut (A) until spacer is held tight.

Then loosen inside jam nut just enough to remove spacer.

Tighten outside jam nut (A) to 40 ft-lbs (54.23 Nm) torque.

Turn tapered stud (D) into housing until it is snug.

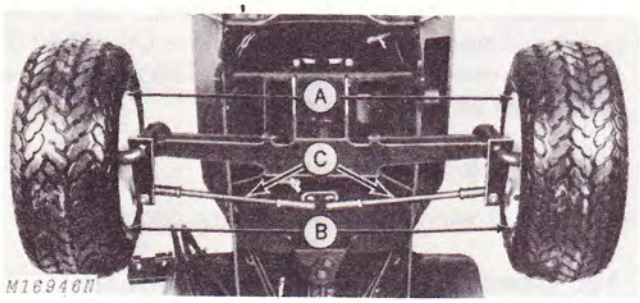
Tighten lock nut (E) to 40 ft-lbs (54.23 Nm) torque.

Give steering backlash a final test by turning steering wheel through its full range of travel.

Connect steering linkage to lever arm (C, Fig. 35).

9. Adjust Front Wheel Toe-In

300, 312 and 316 Tractors (Serial No. 30,001-95,000)



A—Front Dimension **C—Tie Rods**
B—Rear Dimension

Fig. 37-Adjusting Front-Wheel Toe-In on 300, 312 and 316 Tractors (Serial No. 30,001-95,000)

Position front wheels straight ahead, Fig. 37.

Measure front dimension (A) and rear dimension (B).

When properly adjusted, front dimension (A) should be 3/16 inch shorter than rear dimension (B).

To adjust toe-in, shorten or lengthen right-hand and left-hand tie rods (C) equally.

Tighten jam nuts on tie rods firmly.

314 Tractor (Serial No. 95,001-)

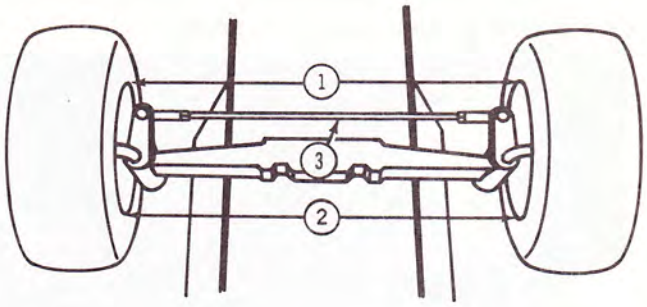


Fig. 38-Adjusting Front-Wheel Toe-In on 314 Tractor (Serial No. 95,001-)

Position front wheels straight ahead, Fig. 38.

1. Measure rear distance between wheels.

2. Measure front distance between wheels.

When properly adjusted, front dimension should be ½ inch plus or minus ¼ inch (12.7 mm ± 6.4 mm) shorter than rear dimension.

To adjust toe-in, shorten or lengthen tie rod.

Tighten jam nut on tie rod firmly.

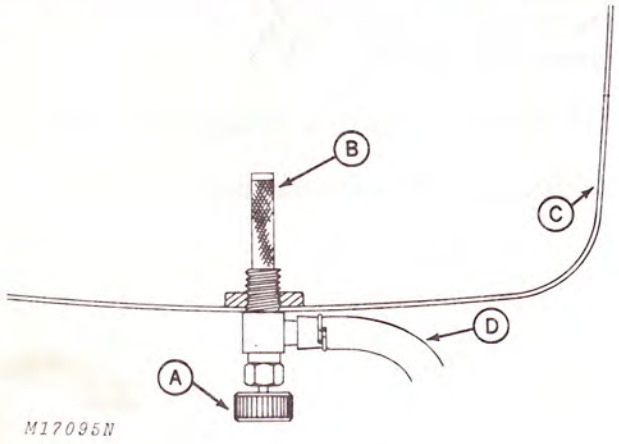
10. Clean Fuel Strainer

CAUTION: Never smoke when working on fuel system. Never work on fuel system in a closed area or near sparks or flame.

Fig. 39-Fuel Shut-Off Valve

Clean the fuel strainer located on bottom of gas tank between rear hitch frame and axle as follows:

Turn fuel shut-off valve knob, Fig. 39, clockwise to close; counterclockwise to open valve.



A—Fuel Shut-Off Valve
B—In-Line Strainer
C—Fuel Tank
D—Hose to Fuel Pump

Fig. 40-In-Line Fuel Strainer

Close the fuel shut-off valve and disconnect the hose to fuel pump (D). Attach a 12-inch length of ¼ inch rubber hose, open the shut-off valve (A) and drain the gas tank into a clean container. Remove hose from valve and unscrew the shut-off valve assembly from the gas tank. Thoroughly clean all particles from the in-line strainer (B).

NOTE: Some tanks have a hose clamp securing fuel shut-off valve. The clamp must be loosened before removing shut-off valve.

Reinstall the valve assembly, close the valve (A, Fig 40), connect the hose (D). Tighten hose clamp, if so equipped. Fill the gas tank. Disconnect hose at fuel pump and open the fuel shut-off valve (A). When gas begins to run out, connect the hose. This procedure will prevent an air lock in the gas line.

11. Check Wiring

Check all wiring for frays or loose connections.

12. Check Belts and Equipment

Check all belts for wear. Check the condition of all extra equipment.

13. Check Tire Pressure

TIRE INFLATION PRESSURES		
Tire	**Front**	**Rear**
High-Flotation Tires (GT-3 Tractor)	16 x 6.50-8 6 to 16 psi (41 to 110 kPa)	23 x 8.50-12 5 to 10 psi (34 to 69 kPa)
Traction Tires (GT-4 Tractor)	4.80 x 4.00-8 12 to 40 psi (82 to 276 kPa)	23 x 8.50-12 5 to 10 psi (34 to 69 kPa)
High-Flotation Tires (GT-5 Tractor)	16 x 6.50-8 6 to 16 psi (41 to 110 kPa)	23 x 10.50-12 5 to 10 psi (34 to 69 kPa)
Traction Tires (GT-8 Tractor)	4.80 x 4.00-8 12 to 40 psi (82 to 276 kPa)	23 x 10.50-12 5 to 10 psi (34 to 69 kPa)

**Inflation will vary with attachment used. Inflation is shown in pounds-per-square-inch (psi) and kilopascals (kPa).*

Litho in U.S.A.

Section 20
KOHLER K301AS, K321AQS AND K341AQS ENGINES
Group 5
GENERAL INFORMATION

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DESCRIPTION

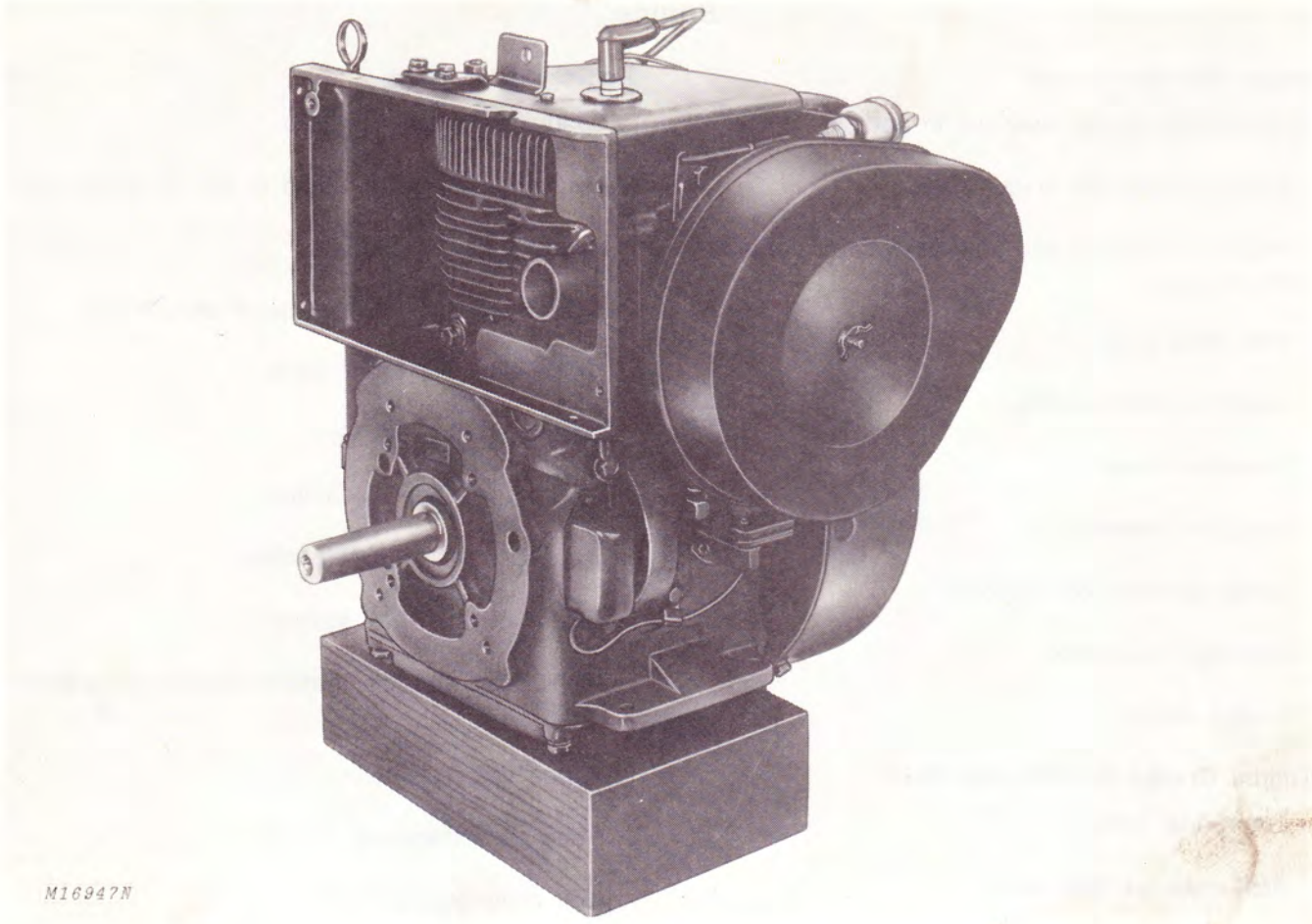


Fig. 1-Kohler 16 hp Engine Model K341AQS Illustrated

Kohler engines are used in the 300, 312, 314 and 316 Tractors. The tractors with their respective engines are as follows:

300 and 316 Tractor - K341AQS - 16 hp
312 Tractor - K301AS - 12 hp
314 Tractor - K321AQS - 14 hp

Each of the four-cycle, L-head, single-cylinder, internal combustion engines has a cast-iron block with a large bore and short stroke.

These air-cooled engines feature anti-friction ball bearings, oil bath lubrication, internal flyweight governors, an alternator charging system and battery coil ignition.

NOTE: 300 Tractors (Serial No. 30,001-73,244) feature a dynamic balancing system. 300 Tractors (Serial No. 73,245-80,000) and all 312, 314 and 316 Tractor engines do not feature the dynamic balancing system. However, if a K341AQS short block is ordered for a 300 or 316 Tractor, the short block will contain balance gears.

Detailed specifications for these engines is listed on pages 20-20-1 through 20-20-4.

Litho in U.S.A.

DIAGNOSING MALFUNCTIONS

Engine

Engine Will Not Crank

Hydrostatic control lever not in neutral.

Battery discharged or defective.

Neutral-start switch and bracket loose or not properly adjusted.

PTO drive engaged.

Defective safety switch.

Defective starter.

Defective solenoid.

Loose electrical connections.

Defective key switch.

Engine seized.

Engine Cranks But Will Not Start

Empty fuel tank.

Restricted fuel tank vent.

Fuel shut-off valve closed (valve below fuel tank).

Clogged, restricted or air-locked fuel line.

Breaker points worn or pitted.

Spark plug fouled or pitted.

Battery not fully charged.

Loose electrical connections.

Faulty condenser.

Defective ignition coil.

Dirt in fuel system.

Frayed wire(s) causing ground(s).

Engine Starts Hard

Spark plug pitted or fouled.

Breaker points worn, pitted or out of adjustment.

Spark plug wire shorted.

Spark plug wire loose at spark plug or coil.

Loose electrical connections.

Restricted fuel tank vent.

Clogged fuel line or air lock.

Broken choke or throttle cable.

Dirt or water in fuel system.

High speed and idle mixture needles not properly adjusted.

Wrong valve clearance.

Head gasket leaking.

Low compression.

Engine Starts But Fails to Keep Running

Restricted fuel tank vent.

High speed and idle mixture needles not properly adjusted.

Broken choke cable.

Dirt or water in fuel system.

Carburetor float leaking or not properly adjusted.

Spark plug wire loose at spark plug or coil.

Spark plug wire shorted.

Breaker points not properly adjusted.

Loose connections.

Defective head gasket.

Faulty condenser.

Litho in U.S.A.

DIAGNOSING MALFUNCTIONS—Continued

Engine Runs But Misses

Spark plug wire loose from spark plug or coil.

Breaker points out of adjustment or worn and pitted.

Spark plug fouled or pitted, incorrect gap.

Loose electrical connections.

Carburetor float leaking or not properly adjusted.

Dirt or water in fuel system.

Wrong valve clearance.

Faulty coil.

Engine shrouding plugged (overheats).

Engine Misses Under Load

Spark plug fouled or pitted, incorrect gap.

High speed and idle mixture needles not properly adjusted.

Incorrect spark plug.

Breaker points out of adjustment or worn and pitted.

Ignition out of time.

Dirt or water in fuel system.

Stale fuel.

Engine Will Not Idle

Idle speed too slow.

Idle mixture needle not properly adjusted.

Dirt or water in fuel system.

Restricted fuel tank filler cap.

Spark plug fouled or pitted, incorrect gap.

Wrong valve clearance.

Low engine compression.

Engine Misses When Advancing Throttle

Cold engine.

High speed and idle mixture needles not properly adjusted.

Spark plug fouled or pitted, incorrect gap.

Linkage misaligned (throttle arm-to-governor).

Engine Loses Power

Crankcase low on oil.

Engine shrouding plugged (overheats).

Excessive engine load.

Restricted air filter.

Dirt or water in fuel system.

High speed and idle mixture needle not properly adjusted.

Spark plug fouled or pitted (incorrect gap).

Too much oil in crankcase.

Low engine compression.

Worn cylinder bore.

Engine Overheats

Dirty or plugged shrouding and engine fins.

High speed and idle mixture needles not properly adjusted.

Too much oil in crankcase.

Crankcase low on oil.

Excessive engine load.

Engine Knocks

Engine out of time.

Excessive engine load.

Crankcase low on oil.

Engine Backfires

High speed and idle mixture needles not properly adjusted.

Loose cylinder head or blown head gasket.

Intake valve sticking in guide.

Ignition out of time.

Litho in U.S.A.

DIAGNOSING MALFUNCTIONS—Continued

Engine Uses Excessive Amount of Oil

Clogged breather assembly.

Breather not assembled properly.

Worn or broken piston rings.

Worn cylinder bore.

Clogged oil holes in piston.

Wrong size piston rings.

Worn valve stems and/or valve guides.

Incorrect oil viscosity.

Faulty breather causing low crankcase vacuum.

Engine Runs Erratically or Surges

Dirt or water in fuel system.

High speed and idle mixture needles not properly adjusted.

Idle speed too slow.

Spark plug fouled or pitted (incorrect gap).

Poor compression.

Faulty breather causing low crankcase vacuum.

Carburetor leaking at gaskets or at connection.

Restricted fuel tank vent.

Throttle-to-governor linkage misassembled.

Throttle-to-governor linkage improperly adjusted.

Breaker points out of adjustment, worn or pitted.

Gasoline in Crankcase

Carburetor float not properly adjusted or leaking.

Float valve and/or seat leaking.

Excessive Vibration

Engine balance gears (300 Tractors Serial No. 30,001-73,244) timed wrong.

Bolts holding engine to engine base are loose.

Misalignment or excessive drive shaft wear.

Loose PTO pulley.

Loose or improperly balanced flywheel.

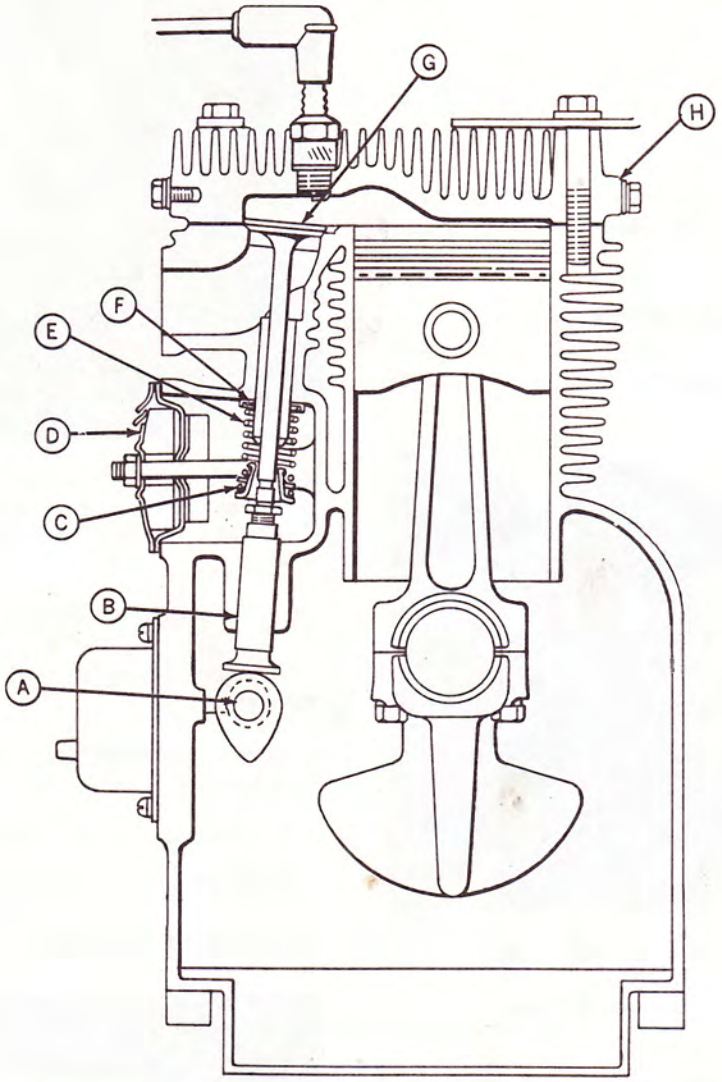
Engine out of time.

Loose flexible coupling between drive shaft and hydrostatic transmission.

Litho in U.S.A.

Group 10
CYLINDER HEAD, VALVES AND BREATHER

GENERAL INFORMATION



M16948N

A—Camshaft
B—Tappet
C—Rotator
D—Breather Assembly
E—Valve Spring
F—Spring Retainer
G—Intake Valve
H—Cylinder Head

Fig. 1-Schematic View of Intake Valve, Tappet and Breather Assembly

It is not necessary to remove the engine to service the cylinder head, valves and breather.

Kohler K301AS, K321AQS and K341AQS engines have valve rotators (C) on both the intake valve (G) and exhaust valve. Both valves have replaceable inserts which are pressed into the block.

Valve guides can be replaced when wear tolerances are exceeded.

The breather assembly (D) is mounted over the valve spring chamber below the carburetor.

Litho in U.S.A.

REMOVAL

300, 314 and 316 Tractors

Remove hood.
Remove side panels.
Remove grille.
Remove hood support.

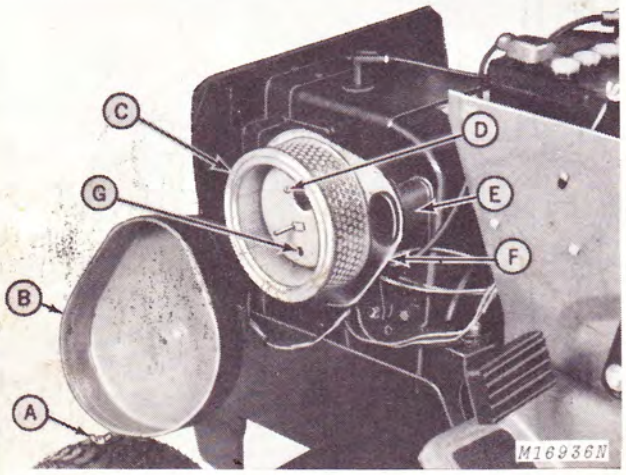
312 Tractors

Remove grille.

Remove four cap screws (two each side) securing hood support to tractor frame. Remove hood support and hood as an assembly.

DISASSEMBLY

Removing Air Cleaner



A—Wing Nut
B—Cover
C—Element
D—Cap Screw
E—Air Intake Tube
F—Base
G—Breather Hose

Fig. 2-Removing Air Cleaner - 300 Tractor Illustrated

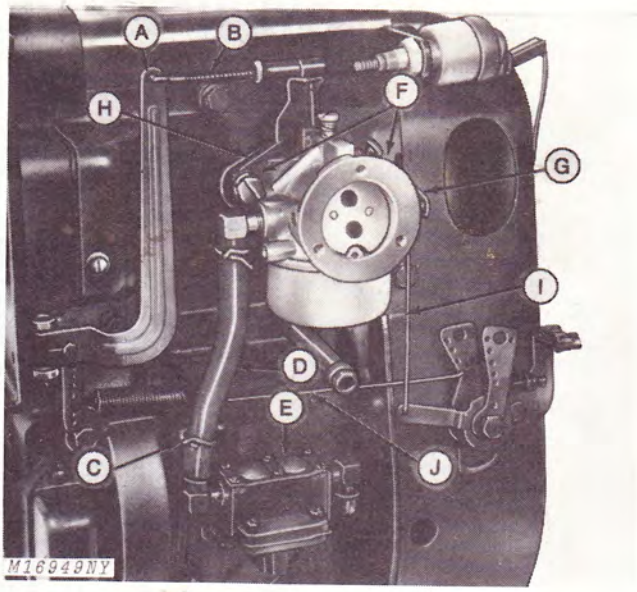
Remove wing nut (A), Fig. 2.

Remove cover (B) and element (C).

Remove cap screws (D) and disconnect breather hose (G). Remove base (F) and air intake tube (E).

NOTE: 312 Tractors (Serial No. 70,001-80,000) are not equipped with air intake tube (E) and breather hose (G).

Removing Carburetor



A—E-Ring
B—Governor Rod
C—Clamp
D—Fuel Line
E—Fuel Pump
F—Screws
G—Carburetor
H—Gasket
I —Choke Link
J —Governor Spring

Fig. 3-Removing Carburetor - 300 Tractor Illustrated

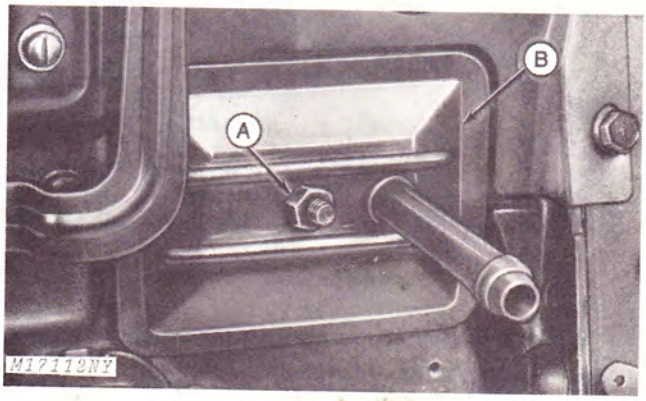
Remove E-ring (A) to disconnect governor rod (B), Fig. 3.

Loosen clamp (C) and disconnect fuel line (D) from fuel pump (E).

Remove carburetor mounting screws (F).

Remove carburetor (G) and gasket (H).

Removing Breather



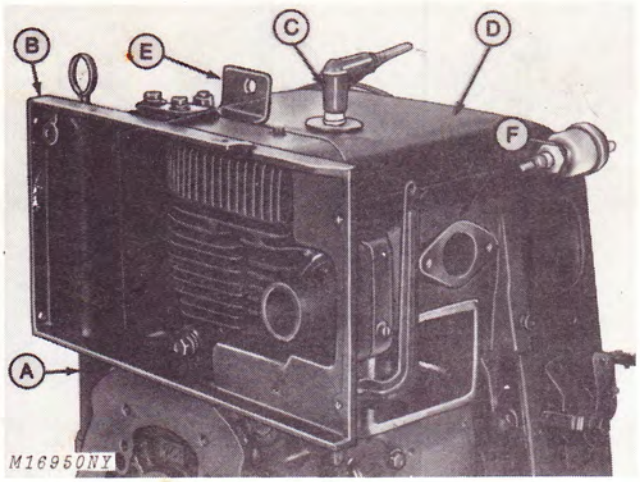
A—Nut and Lock Washer
B—Breather Assembly

Fig. 4-Removing Breather - 300 Tractor Illustrated

Remove nut and lock washer (A), Fig. 4.

Remove breather assembly (B).

Removing Air Duct and Baffles on 300, 314 and 316 Tractors



A—Oil Fill Tube
B—Air Duct
C—Spark Plug
D—Head Baffle
E—Lift Strap
F—Side Air Baffle

Fig. 5-Removing Air Duct and Baffles on 300, 314 and 316 Tractors

NOTE: Oil fill tube (A) must be removed to reach screw holding air duct (B).

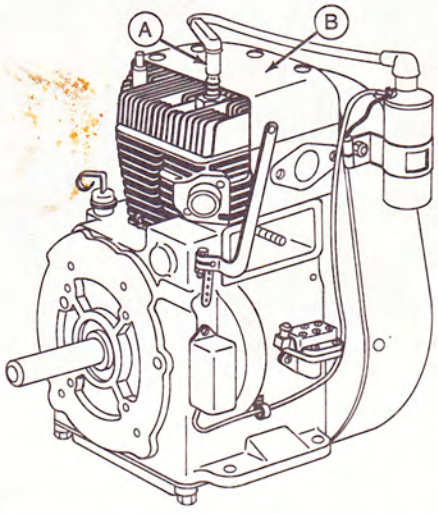
Remove air duct (B), Fig. 5.

Remove spark plug (C).

Remove head baffle (D) and lift strap (E).

Remove side air baffle (F).

Removing Spark Plug and Baffle on 312 Tractor



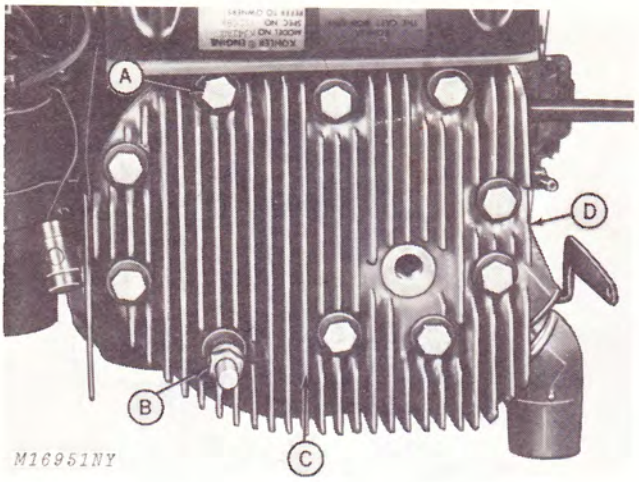
A—Spark Plug
B—Head Baffle

Fig. 6-Removing Spark Plug and Baffle on 312 Tractor

Remove spark plug (A).

Remove head baffle (B).

Removing Cylinder Head



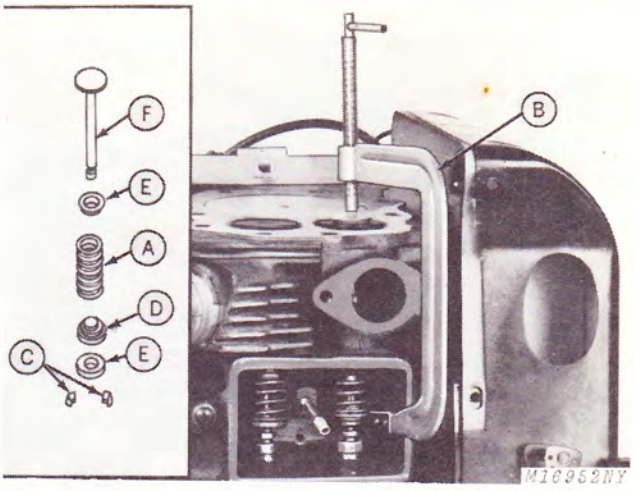
A—Cylinder Head Bolt
B—Cylinder Head Nut
C—Cylinder Head
D—Gasket

Fig. 7-Removing Cylinder Head-K341AQS Engine Illustrated

Remove cylinder head bolts (A) and nut (B), Fig. 7.

Remove cylinder head (C) and gasket (D).

Removing Valves



A—Valve Spring
B—JDM-70 Valve Spring Compressor
C—Valve Keepers
D—Rotator
E—Retainers
F—Valve

Fig. 8-Removing Valves

NOTE: Use same procedure for both valves.

Compress valve spring (A) with JDM-70 Valve Spring Compressor (B).

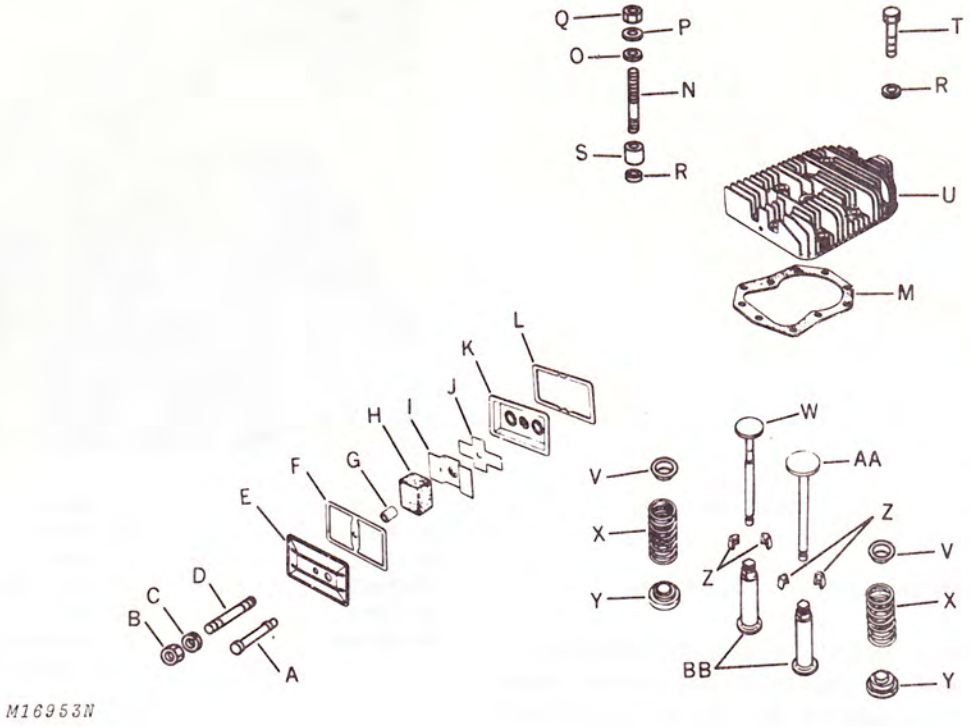
Remove valve keepers (C) from valve stem with a magnet.

Remove valve spring compressor.

Remove valve (F) from cylinder block.

Remove valve spring (A), rotator (D), and retainers (E) from valve chamber.

INSPECTION AND REPAIR



A—Breather Hose
B—Nut
C—Lock Washer
D—Stud
E—Cover
F—Gasket
G—Seal
H—Filter
I —Baffle
J —Reed
K—Plate
L —Gasket
M—Cylinder Head Gasket
N—Stud
O—Lock Washer
P—Flat Washer
Q—Nut
R—Flat Washer (11 used)
S—Spacer
T—Cap Screw (9 used)
U—Cylinder Head
V —Retainer (4 used)
W —Exhaust Valve
X —Valve Spring (2 used)
Y —Rotator (2 used)
Z —Keeper (4 used)
AA—Intake Valve
BB—Tappet (2 used)

Fig. 9-Exploded View of Cylinder Head, Valves and Breather For K341AQS Engine

Inspecting Cylinder Head

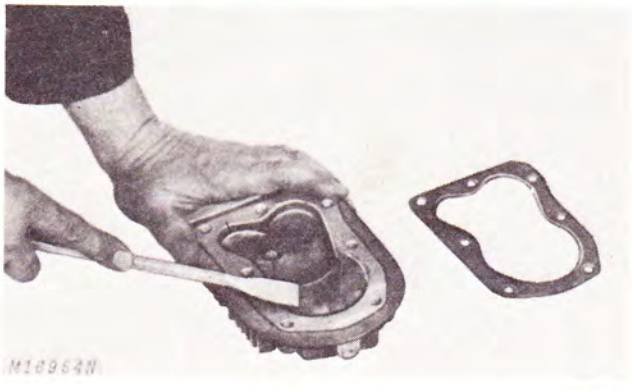


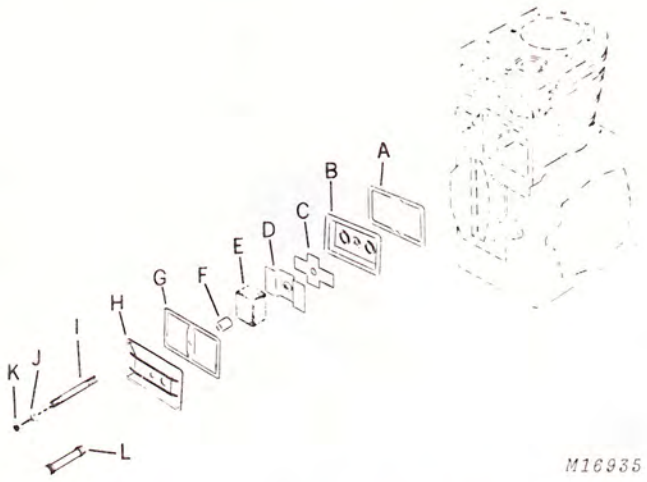
Fig. 10-Cleaning Cylinder Head

Remove all deposits from combustion chamber and gasket surface of cylinder head with a scraper and a wire brush, Fig. 10.

Be careful not to damage the cylinder head gasket surface. Use a safe cleaning solvent to remove dirt, grease and other deposits.

Check the cylinder head for cracks or broken cooling fins. Inspect the gasket surface for burrs and nicks.

Replace the head if necessary.



M16935N

A—Cylinder Head
B—Surface Plate
C—Feeler Gauges

Fig. 11-Checking Cylinder Head Surface

When the cylinder head (A) is removed because of a gasket leak, check the flatness of the cylinder head. Place it on a surface plate (B), Fig. 11. Use a 0.003-inch (0.076 mm) flat feeler gauge (C) to see that gasket surface makes contact at all points.

NOTE: Whenever the cylinder head is removed, discard the old head gasket. Install a new head gasket.

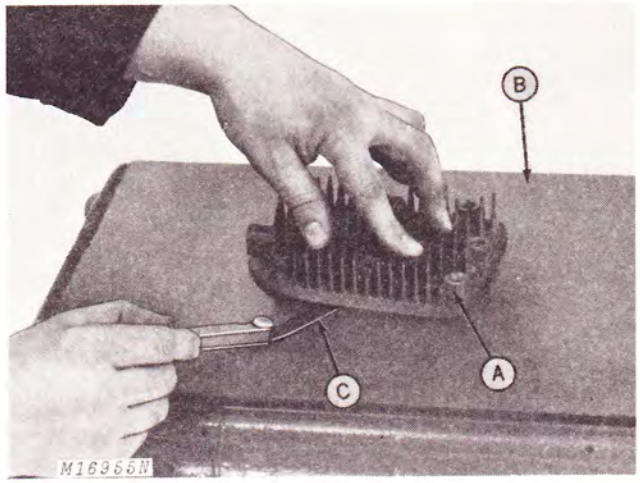
Inspecting Breather

Thoroughly clean all "metal" breather assembly components Fig. 12, in solvent.

NOTE: Install new gaskets (A and G) whenever breather is removed.

Clean hose (L) and spacer (F) with soap and water.

NOTE: 312 Tractors are not equipped with hose (L).



M16935

A—Gasket
B—Plate
C—Reed
D—Baffle
E—Filter
F—Spacer
G—Gasket
H—Cover
I —Stud
J —Lock Washer
K—Nut
L —Hose (K321AQS and K341AQS Engine Only)

Fig. 12-Inspecting Breather

On 300, 314 and 316 Tractors inspect hose (L) for cracks.

Replace gaskets (A and G).

Replace filter (E) if it cannot be adequately cleaned.

Inspect reed (C) for warpage, cracks or damage.

Inspect plate (B) for pits or burrs around breathing holes that could cause leakage past reed. Be sure drain hole in bottom of plate (B) is not clogged.

Valve Analysis

Analyze valve condition before cleaning, grinding or discarding.

Fig. 13-Lead Deposits on Leaky Intake Valve

Lead deposits on the intake valve, Fig. 13, consist mostly of lead and some metal which comes from the lubricating oil. Lead deposits are caused by a small amount of exhaust gas leakage into the intake port area. This indicates that the valve is not seating properly. Grind the valve, and reface the seat to correct this condition.

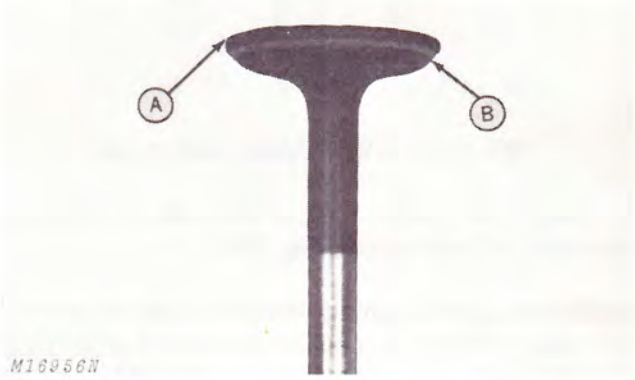
NOTE: Correct valve-to-tappet clearance after grinding valves.

Fig. 14-Valve Stem Corrosion

Valve stem corrosion, Fig. 14, can be caused by moisture in the fuel-air mixture condensing inside the engine, if the engine is stopped prior to warm-up.

Such corrosion can also occur during storage, if the engine has not been run for some time. Fogging (pouring oil in the combustion chamber) before storing will prevent valve corrosion.

Corroded and pitted valves collect deposits which cause valve sticking. Replace badly corroded or pitted valves with new valves.



A—Margin **B—Face**

Fig. 15-Exhaust Valve Running too Hot

Exhaust valves are designed to function in temperatures exceeding 5000°F (2760°C). However, when operating at this temperature for long periods of time, valve burning occurs, Fig. 15. Indications of valves running too hot are (1) the dark discoloration of the valve stem down into the area protected by the valve guide. (2) distortion of the valve margin and valve face, and (3) valve inserts beginning to burn away.

The most common cause of an overheated engine and valves is poor cooling due to dirt or obstructions inside the intake shrouding. Remove and clean shrouding and all cooling fins on the engine if this condition is noticed.

NOTE: Never run engine with shrouding removed.

Also check for improper valve timing by checking and correcting valve clearance.

Other causes of valves running hot are worn valve guides or valve springs, a lean fuel mixture, an improper spark plug, or an overheated spark plug, which causes pre-ignition.

Fig. 16-Gummy Valve Causing Valve To Stick

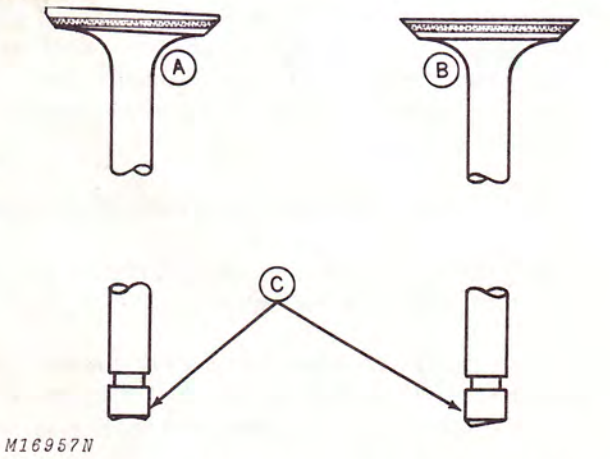
Using stale gasoline left in the tank is a common cause of sticking valves, Fig. 16.

Sometimes this gummy substance can be seen on the valve. When this condition is found, it is likely that the carburetor also contains gum deposits and will require a complete cleaning.

Advise customer to use fresh gasoline and to drain gasoline from all fuel lines and carburetor before storing tractor.

Inspecting Valves

Remove carbon from valve head, face and stem with a power-operated wire brush. Be sure carbon is removed and not merely burnished. Any carbon left on the stem will affect accurate alignment in the valve refacer collet.



A—Warped Head B—No Margin C—Worn Valve Stems

Fig. 17-Faulty Valves

Check valve face, head and stem, Fig. 17, for defects. Look for bent valve stems or excessive corrosion-caused pits on valve face or stem. Replace valve with a warped head (A) or with less than 1/32-inch (0.794 mm) margin (B).

Valve stem ends should be ground square before checking valve tappet clearance.

Inspecting Valve Springs

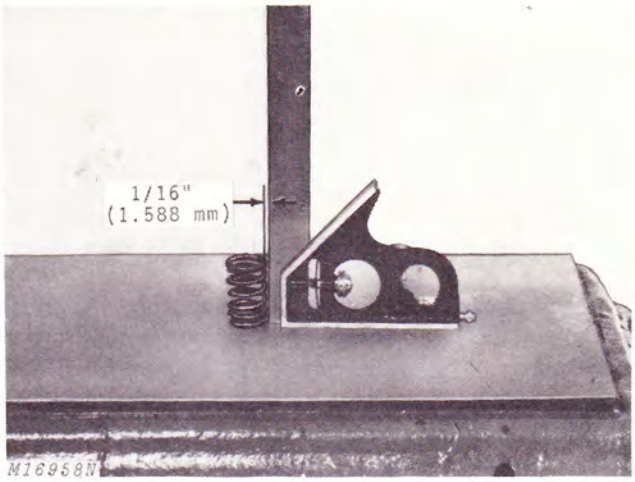


Fig. 18-Valve Spring Squareness (New Spring)

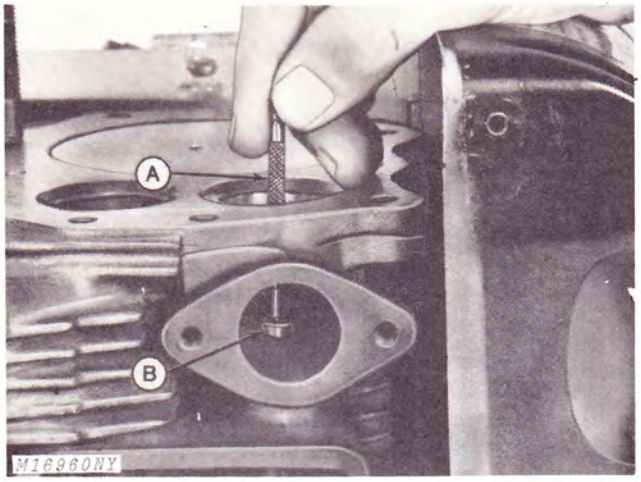
Use a steel square and surface plate to check the valve spring for squareness. Stand the spring and square on surface plate. Place the spring next to the square, Fig. 18. Revolve the spring slowly and observe the clearance between the top coil and the square. Clearance should not exceed 1/16-inch (1.588 mm).

Fig. 19-Valve Spring Tension

Check valve spring for proper pressure, Fig. 19. Refer to "Specifications", Group 20, for free length of the spring and the pressure that spring should exert when it is compressed to a measured length.

Inspecting Valve Guides

Clean valve guides with a power-driven wire brush of the correct size. Run the brush up and down the full length of the guide. A few drops of light oil or kerosene will help fully clean the guide.



A—Telescoping Gauge **B—Valve Guide**

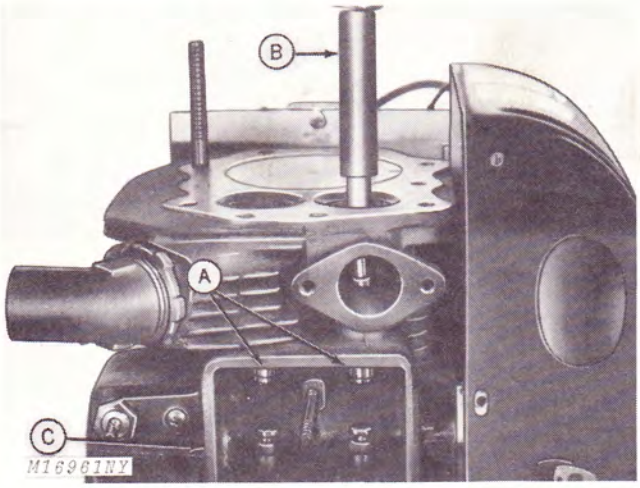
Fig. 20-Measuring Valve Guides

1. Measure inside of valve guide (B) with gauge (A) from JDM-61 Telescoping Gauge Set, Fig. 20.
2. Read measurement with a JDM-57 Dial Caliper.

Replace guides exceeding the specifications shown in Group 20.

NOTE: Valve guides do not wear uniformly. Measure at different points within the guide.

Replacing Valve Guides

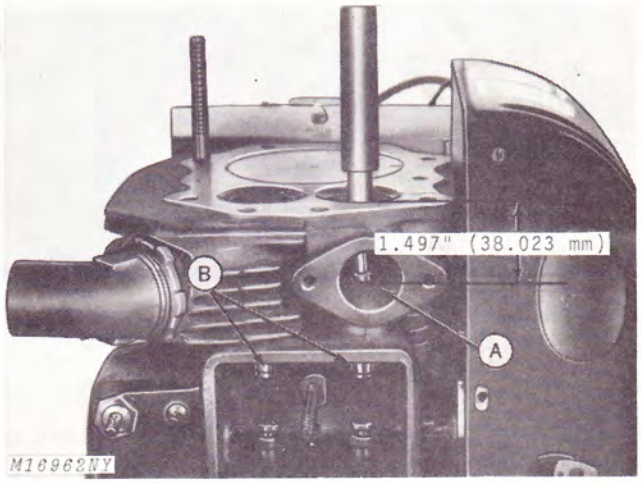


A—Valve Guides **B—JDM-69 Valve Guide Driver**
C—Valve Chamber

Fig. 21-Removing Valve Guides

Use a JDM-69 Valve Guide Driver (B) to drive valve guides (A) into valve chamber (C), Fig. 21. Carefully break protruding end of guide and continue to drive guide into valve chamber until it is removed.

IMPORTANT: Be careful not to damage block or tappets when breaking old guides.



A—Guide Depth **B—Valve Guides**

Fig. 22-Installing Valve Guide

Thoroughly clean valve guide bore.

Install valve guide with a JDM-69 Valve Guide Driver. Drive valve guide (B) in to the proper guide depth (A), Fig. 22.

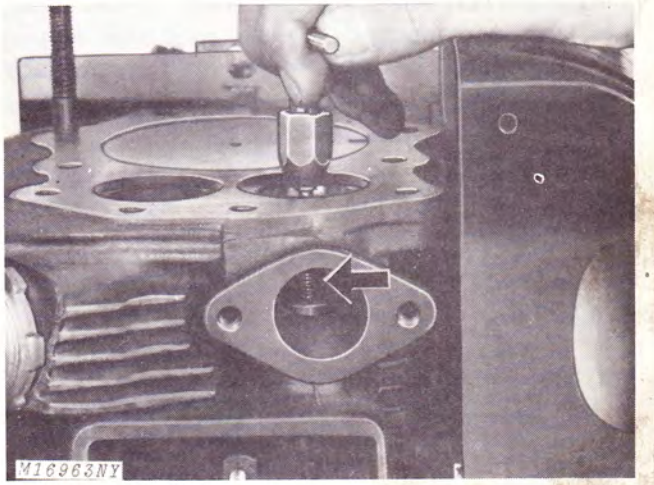


Fig. 23-Reaming Valve Guide

Use a JDM-51-3 Reamer, Fig. 23, to finish-ream valve guide. The JDM-51-3 Reamer can be used to clean carbon from valve guide or to check for proper clearance in a new guide.

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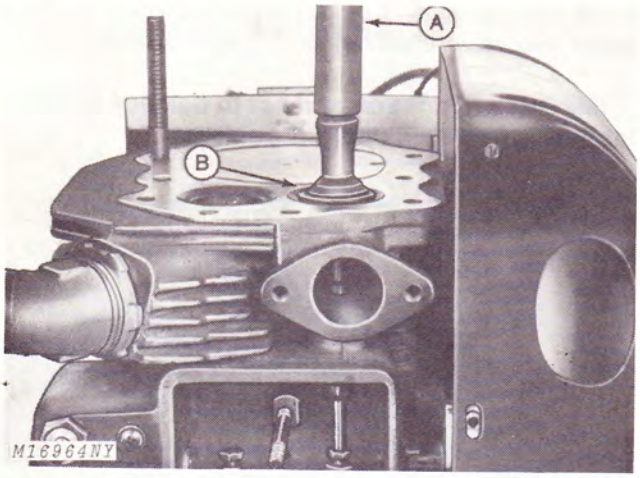
Lapping Valves



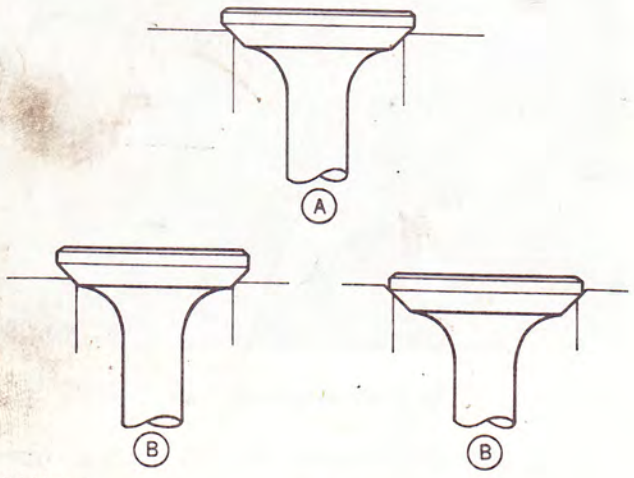
A—Vacuum Cup Tool **B—Valve**

Fig. 24-Lapping Valves

Coat face of valve sparingly with a fine grade of valve lapping compound. Use a vacuum cup tool (A), Fig. 24, (from JDM-54 Valve Lapper Set) to grip top of valve (B). Rotate valve in a circular motion in valve seat.

Lift valve from seat every 8 or 10 strokes to keep compound equalized on surface of valve seat. Continue valve lapping operation until a uniform lapping ring appears around entire surface of valve face. When a good seal is attained, wash all parts with solvent to remove all traces of lapping compound. Dry parts thoroughly.

Note position of valve seat marked on valve face. The lapping mark made by the seat after lapping should appear on or near the center of the valve face, Fig. 25.



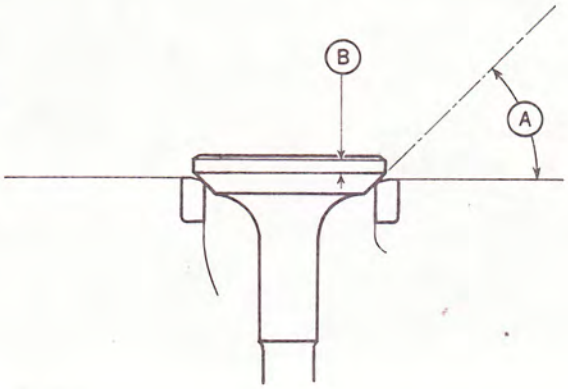
A—Correct **B—Incorrect**

Fig. 25-Valve-to-Seat Relationship

When matching valves to seats, Fig. 27, be sure valve seat is nearly centered on the valve face. The position of the valve in the seat is clearly evident after lapping the valve.

If lapping valves does not provide sufficient seating, recondition or replace valves and valve guides.

Reconditioning Valves



A—Valve Face Angle **B—Valve Margin**

Fig. 26-Grinding Valve

Reface the valve at 45° angle (A) on a valve grinder until seating surface is cleaned up. If after grinding, the valve margin (B) is less than 1/32-inch (0.794 mm), Fig. 26, the valve must be replaced. Knife edges lead to breakage, burning and pre-ignition because heat localizes on the edge. If margin is uneven after grinding, it indicates the head is warped.

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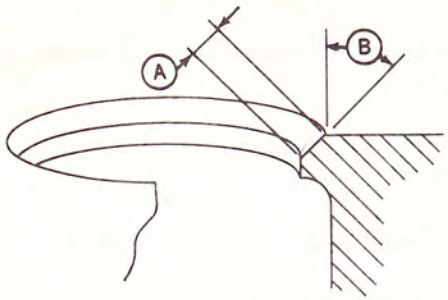
Reconditioning Valve Seat



A—Seating Surface **B—Seating Angle**

Fig. 27-Cutting Valve Seat Angle

Cut valve seat angle (B) to 45° with JDM-52 Valve Seat Cutter. Then (cut back) seating surface (A) to 1/32-inch (0.794 mm), Fig. 27. Maximum width of seating surface is 1/16 inch (1.588 mm). Narrow the seats with 30° side of JDM-52 Valve Seat Cutter.

Broken or excessively burned or pitted valve seats can be replaced, see Fig. 28.

Replacing Valve Seat

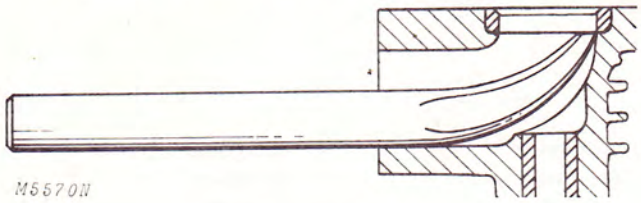


Fig. 28-Removing Valve Seat

Remove valve seat with an extractor, Fig. 28, or a valve seat puller. Clean seat area thoroughly before installing new seat.

The valve seat is retained by press fit only. Chill both the insert and driving tool in dry ice before pressing seat into block.

Adjusting Valve Clearance

Valve lapping or grinding changes the tappet-valve clearance. Check valve clearance.

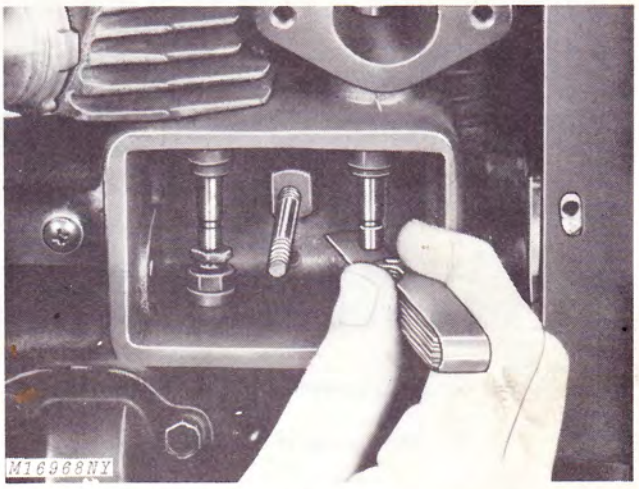


Fig. 29-Checking Valve Clearance

Place valves without springs in valve guides.

Rotate crankshaft until piston is at top-dead-center (TDC) on the compression stroke. Both valves must be completely closed.

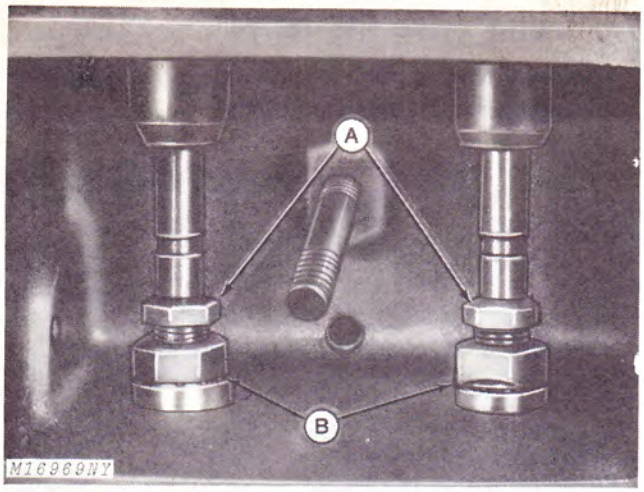
NOTE: The piston must be in this position to insure that the exhaust valve is not riding on the automatic compression release mechanism.

Hold valve firmly on seat.

Check clearance with a flat feeler gauge, Fig. 29.

Intake valve clearance should be 0.008 to 0.010 inch (0.203 to 0.254 mm), and exhaust valve clearance 0.017 to 0.020 inch (0.431 to 0.508 mm).

Adjust valve clearance, Fig. 30.



A—Tappet Adjusting Screw **B—Tappet**

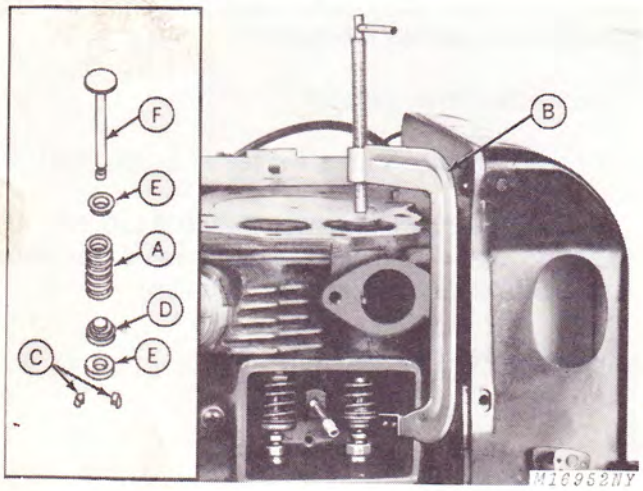
Fig. 30-Adjusting Valve Clearance

Hold flat area of tappet (B) with an open-end wrench, Fig. 30.

Turn tappet adjusting screw (A) with an open-end wrench up or down until proper clearance is obtained.

ASSEMBLY

Installing Valves



A—Valve Spring
B—JDM-70 Valve Spring Compressor
C—Valve Keepers
D—Rotator
E—Retainers
F—Valve

Fig. 31-Installing Valves

Place valve spring (A) (tight coils up) with retainers (E) and rotator (D) in valve chamber.

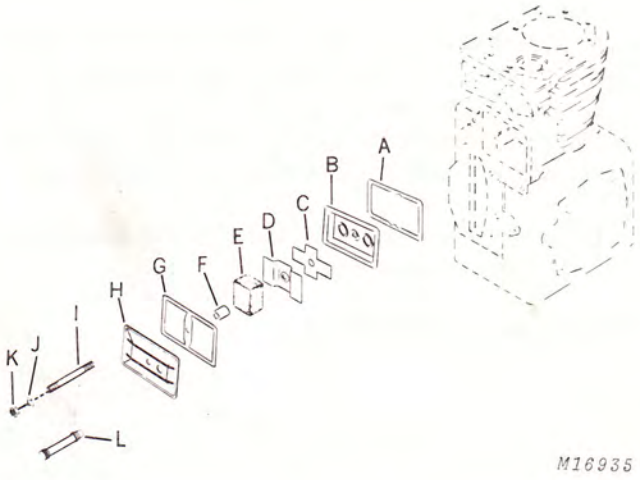
Lubricate valve stem and install valve (F) in valve guide.

Compress spring with JDM-70 Spring Compressor (B).

Install keepers (C) and remove spring compressor.

NOTE: Install keepers with a keeper tool or apply grease to keepers to hold them in place when installing them by hand.

Installing Breather



A—Gasket
B—Plate
C—Reed
D—Baffle
E—Filter
F—Spacer
G—Gasket
H—Cover
I —Stud
J —Lock Washer
K—Nut
L—Hose

Fig. 32-Breather Assembly

Install components of breather assembly exactly as shown, Fig. 32. Use new gaskets (A and G) if old gaskets are damaged. Make sure small hole on bottom of plate (B) is down.

NOTE: 312 Tractors (Serial No. 70,001-80,000) are not equipped with hose (L).

Installing Cylinder Head

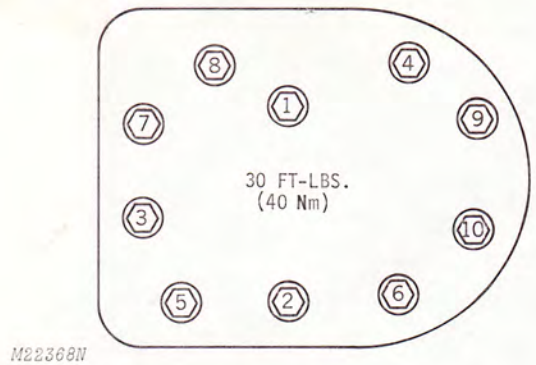


Fig. 33-Cylinder Head Torquing Sequence for 300, 314 and 316 Tractors

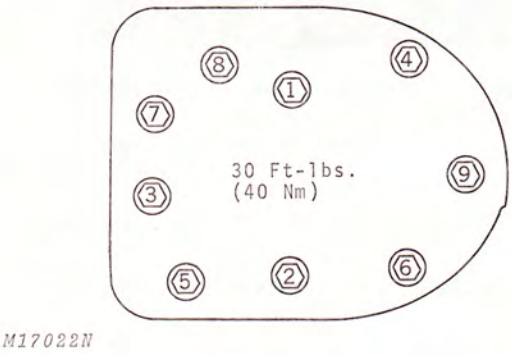


Fig. 34-Cylinder Head Torquing Sequence for 312 Tractor

Always install a new head gasket when head has been removed. This will insure a gas-tight fit.

IMPORTANT: Install head gasket dry. Do not use Permatex or other sealant on gasket.

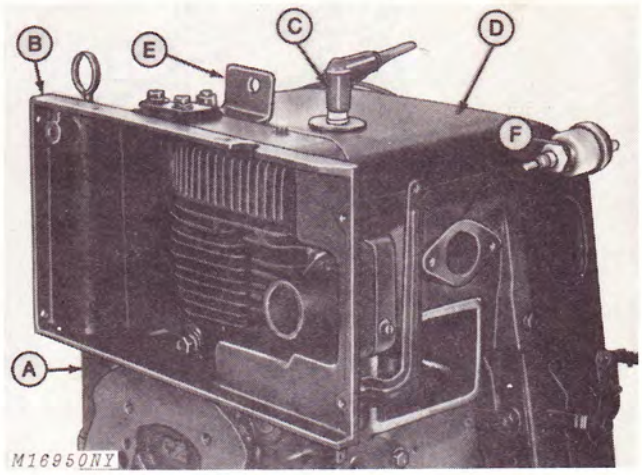
Install head gasket and cylinder head, Fig. 33 or 34 for respective tractor.

Clean and apply light film of oil to cylinder head bolts and nut to insure an accurate torque reading. Install washers on bolts with sharp edges of washers down against cylinder head.

Tighten head bolts in sequence shown, Fig. 33 or 34 for respective tractor, to 100 in-lbs (11.52 Nm) torque. Continue tightening in sequence in 20 in-lb (3.62 Nm) steps until you reach torque shown in "Specifications" Group 20.

After initial "run-in" period, let engine cool, then retorque cylinder head bolts and nut.

Installing Air Duct and Baffles on 300, 314 and 316 Tractors



A—Oil Fill Tube
B—Air Duct
C—Spark Plug
D—Head Baffle
E—Lift Strap
F—Side Air Baffle

Fig. 35-Installing Air Duct and Baffles

Install side air baffle (F), Fig. 35.

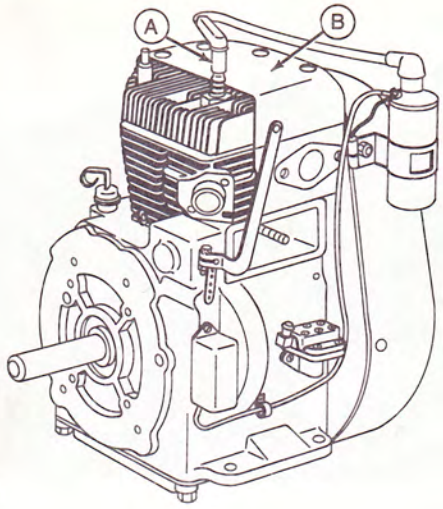
Install head baffle (D) and spark plug (C).

Install air duct (B).

Install lift strap (E).

Install oil fill tube (A).

Installing Spark Plug and Baffle on 312 Tractor



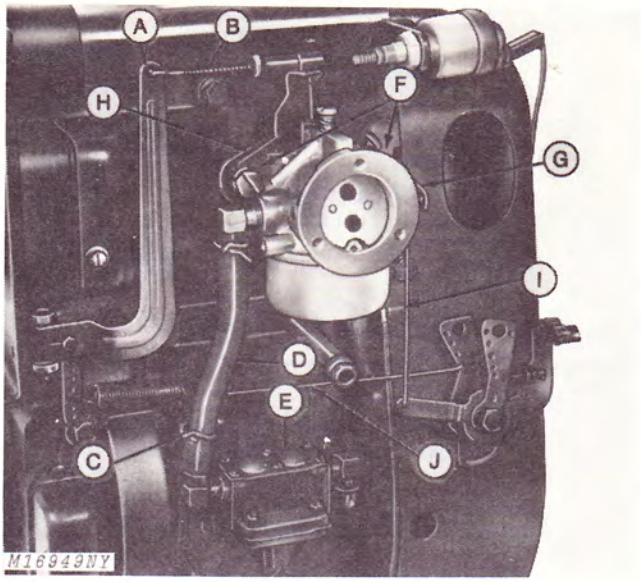
A—Spark Plug **B—Baffle**

Fig. 36-Installing Spark Plug and Baffle on 312 Tractor

Install spark plug (A), Fig. 36.

Install head baffle (B).

Installing Carburetor



A—E-Ring
B—Governor Rod
C—Clamp
D—Fuel Line
E—Fuel Pump
F—Screws
G—Carburetor
H—Gasket
I —Choke Link
J —Governor Spring

Fig. 37-Installing Carburetor—300 Tractor Illustrated

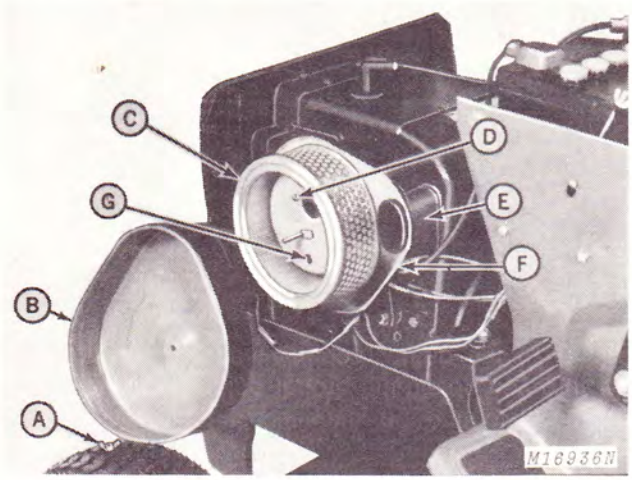
Install gasket (H) and carburetor (G). Fig. 37.

Tighten carburetor mounting screws (F).

Connect fuel line (D) to fuel pump (E) and install clamp (C) over fuel line.

Connect governor rod (B) and install E-ring (A).

Installing Air Cleaner



A—Wing Nut
B—Cover
C—Element
D—Cap Screw
E—Air Intake Tube
F—Base
G—Breather Hose

Fig. 38-Installing Air Cleaner—300 Tractor Illustrated

Install air intake tube (E) and base (F), Fig. 38.

NOTE: 312 Tractors (Serial No. 70,001-80,000) are not equipped with air intake tube (E) and breather hose (G).

Tighten cap screws (D).

Connect breather hose (G) to base (F).

Install element (C).

Install cover (B). Make sure seal on cover fits correctly between cover (B) and base (F).

Tighten wing nut (A).

Adjust Carburetor and Governor Linkage

Adjust carburetor and governor linkage as explained in Section 30.

Installing Hood and Side Panels on 300, 314 and 316 Tractors

Install hood support.

Install grille.

Install side panels.

Install hood.

Installing Hood Support, Hood, and Grille on 312 Tractor

Bolt hood support with hood to tractor frame with four cap screws.

Install grille.

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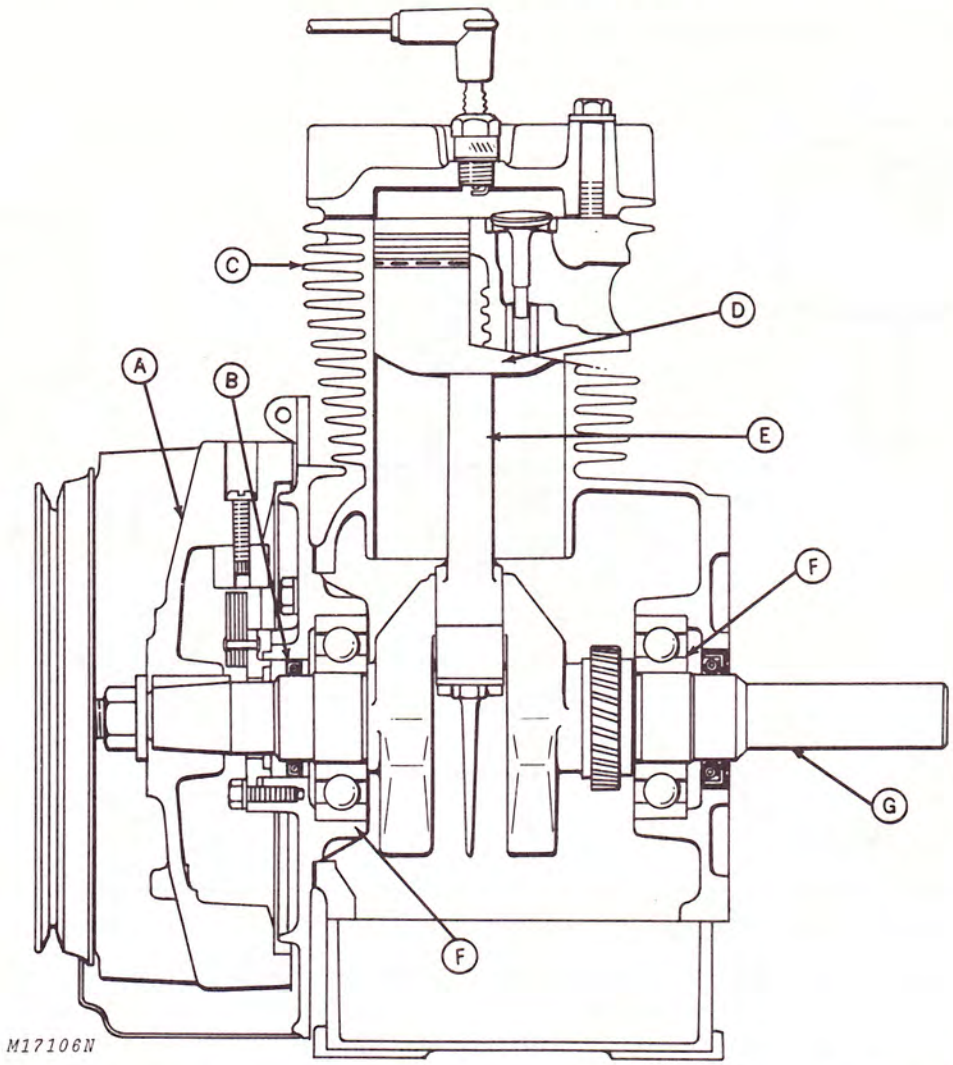
Group 15
INTERNAL COMPONENTS

GENERAL INFORMATION



A—Flywheel
B—Oil Seal
C—Cylinder Block
D—Piston
E—Connecting Rod
F—Main Bearings
G—Crankshaft

Fig. 1-Schematic View of Kohler Engine

Oversize pistons and rings and undersize connecting rods are available for Kohler Engines, Fig. 1.

A short block or complete engine is available if many internal components are worn beyond repair.

NOTE: All original equipment Kohler K341AQS Engines (Serial No. 7597673-) do not have balance gears. However, short blocks for K341AQS engines will contain the balance gears. This affects both the 300 and 316 Tractors.

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Dynamic Engine Balancing System on 300 Tractors (Serial No. 30,001-73,244)

The K341AQS Kohler Engine (Serial No. - 7597672) balancing system consists of two balance gears, which run on needle bearings. Snap rings hold these on stub shafts, which are press-fitted into special bosses in the crankcase. Spacer washers control end play. The gears are driven by the crankgear in the opposite direction of crankshaft rotation.

The crankshaft counterweights alone cannot effectively control engine vibration. If the counterweight were designed to exactly balance the maximum force, they would create an unbalance when this maximum force dropped to zero at the 90 and 270 degree positions.

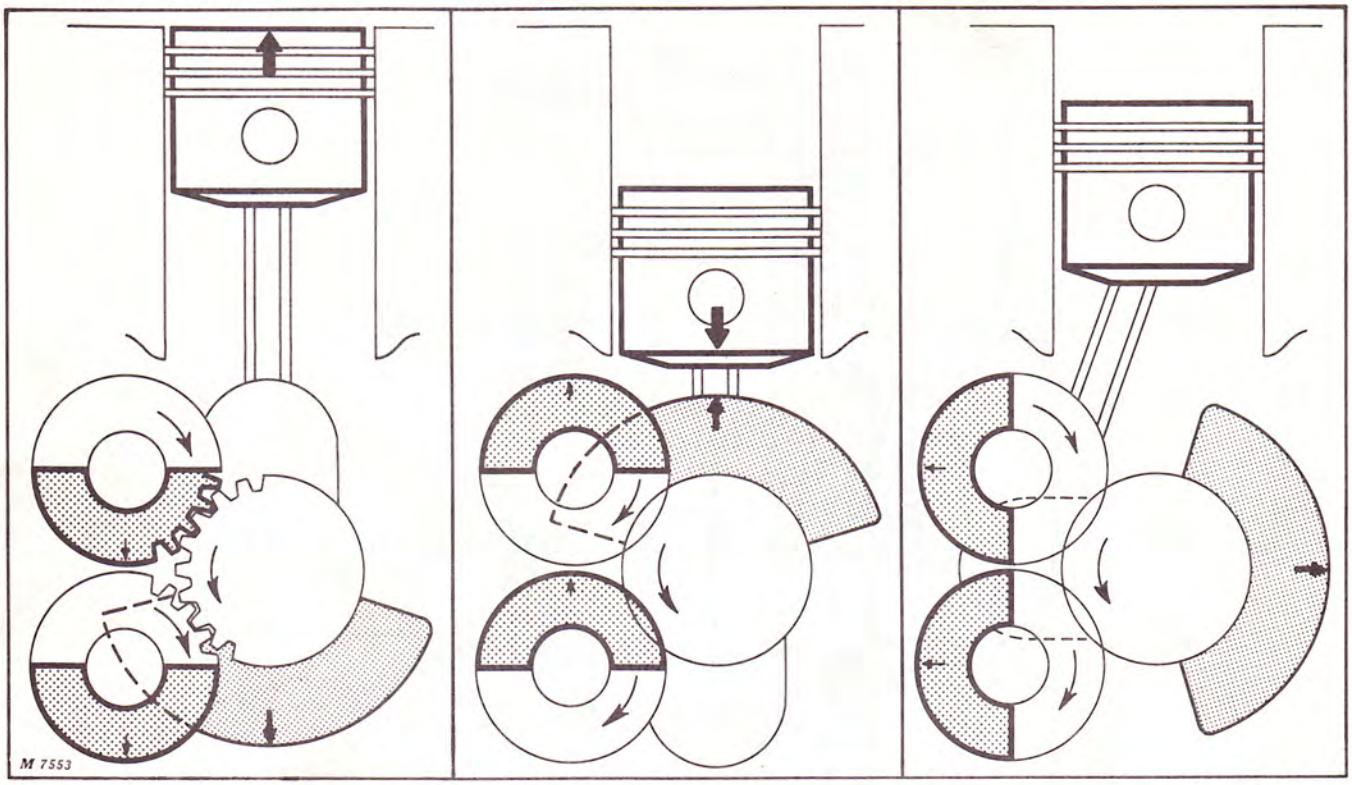


Fig. 2-Piston at Top Dead Center (TDC) *Fig. 3-Piston on Bottom Dead Center (BDC)* *Fig. 4-Piston Midway in Cylinder*

The balance gears oppose and then add to the force exerted by the crankshaft counterweights to effectively reduce vibration. Both horizontal and vertical forces are thus reduced, resulting in smoother operation with less vibration.

Fig. 2 shows how the reciprocating weights (piston, piston pin and connecting rod) exert maximum force upward (large arrow) while the crankshaft counterweights exert force (medium arrow) in the opposite direction.

In this position, the balance gears (small arrows) each add to the force of the crankshaft counterweights to balance the opposing forces.

This same balancing effect is evident when the piston reaches bottom dead center, Fig. 3. However, now the two forces are directed toward each other.

When the piston is midway in the cylinder, Fig. 4, no vertical inertial force is exerted. The crankshaft counterweights now exert a force horizontally. The balance gears exert force in the opposite direction to counteract the force of the counterweights.

When the crankshaft has rotated another 180 degrees and the piston is again midway in the cylinder the force of the balance gears is directed inward while that of the counterweights is outward.

When working on dynamically-balanced engines be sure you obtain the proper balance gear end play and have the gears properly timed to the engine.

Litho in U.S.A.

Automatic Compression Release Camshaft

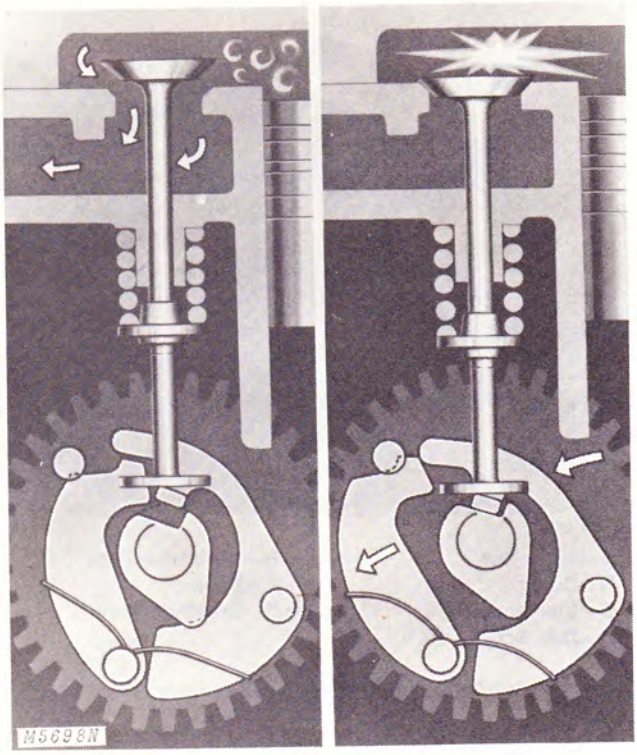


Fig. 5-ACR Operation

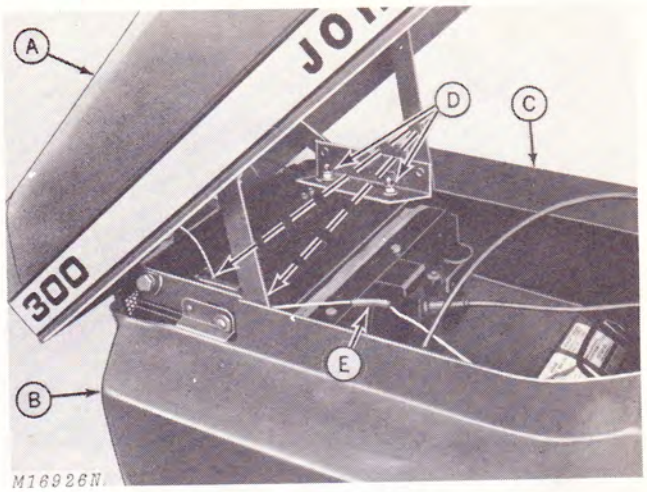
Automatic compression release provides a reduction in cranking effort by holding the exhaust valve open slightly during the first part of the compression stroke. This allows part of the fuel-air mixture to escape, lowering the compression pressure, Fig. 5. This feature is especially valuable during cold weather starting.

By releasing compression, the pressure of the burning mixture is reduced sufficiently for the flywheel to carry the engine over top-dead-center. This prevents "kick-back" and eliminates the need for the spark retard mechanism.

When the engine speed reaches approximately 650 rpm, centrifugal force disengages the automatic compression release allowing the engine to operate in the usual manner at all higher speeds, with no loss of power.

ENGINE REMOVAL

Removing Hood, Side Panels and Grille on 300, 314 and 316 Tractors



A—Hood
B—LH Side Panel
C—RH Side Panel
D—Nut
E—Headlight Harness

Fig. 6-Removing Hood and Side Panels

Tilt hood (A) forward, Fig. 6.

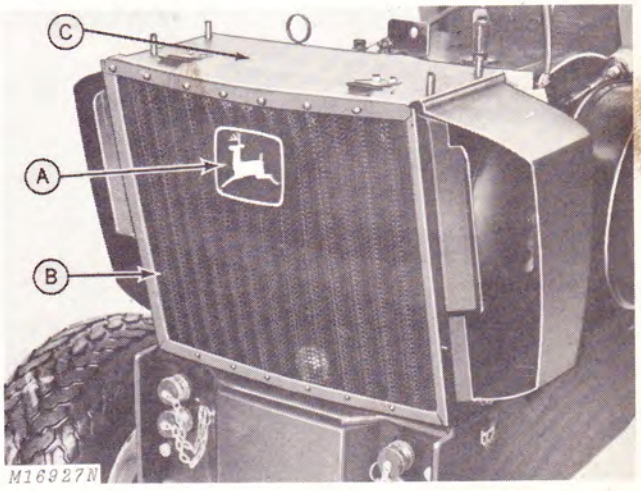
Remove left-hand side panel (B).

Remove right-hand side panel (C).

Disconnect headlight harness (E).

Remove four nuts (D) on 300 and 316 Tractors. Remove four bolts on 314 Tractor.

Lift hood (A) from tractor.



A—Grille Emblem **B—Grille** **C—Hood Support**

Fig. 7-Removing Hood Support

Place your hand under grille emblem (A) and pull out to remove grille (B), Fig. 7.

Remove hood support (C).

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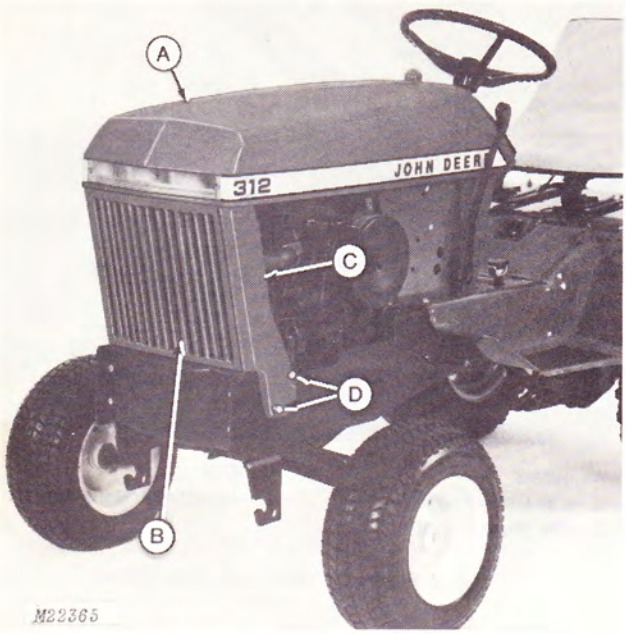
ENGINE REMOVAL—Continued

Removing Hood Support, Hood, and Grille on 312 Tractor



A—Hood
B—Grill
C—Hood Support
D—Cap Screws

Fig. 8-Removing Hood, Hood Support and Grill

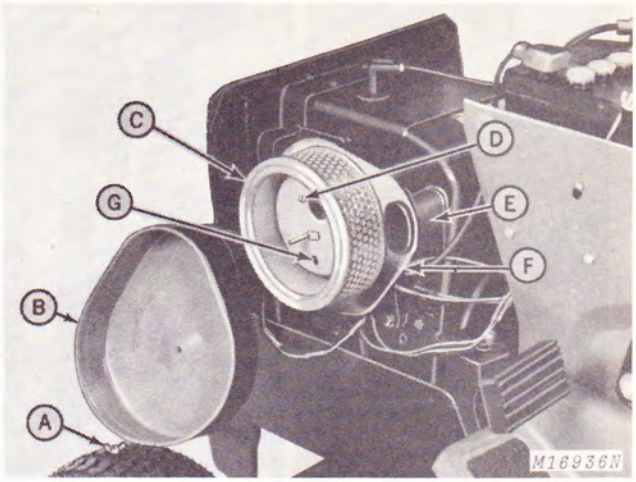
Remove grill (B), Fig. 8.

Tilt hood (A) forward.

Remove two cap screws (D) on each side of hood support (C).

Remove hood with hood support.

Removing Air Cleaner



A—Wing Nut
B—Cover
C—Element
D—Cap Screw
E—Air Intake Tube
F—Base
G—Breather Hose

Fig. 9-Removing Air Cleaner—300 Tractor Illustrated

Remove wing nut (A), Fig. 9.

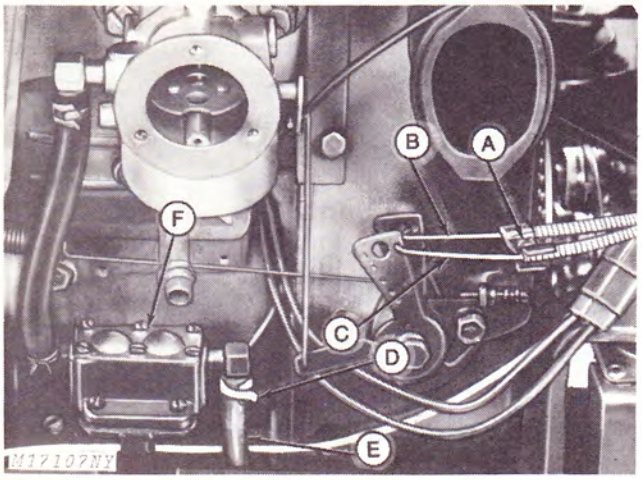
Remove cover (B) and element (C).

Remove cap screws (D) and disconnect breather hose (G).

Remove base (F) and air intake tube (E).

NOTE: 312 Tractors (Serial No. 70,001-80,000) are not equipped with breather hose (G) and air intake tube (E).

Disconnecting Throttle Cable, Choke Cable and Fuel Line



A—Clamp Screw
B—Throttle Cable
C—Choke Cable
D—Clamp
E—Fuel Line
F—Fuel Pump

Fig. 10-Disconnecting Throttle Cable, Choke Cable and Fuel Line—K341AQS Engine Illustrated

Loosen clamp screw (A), Fig. 10.

Disconnect throttle cable (B).

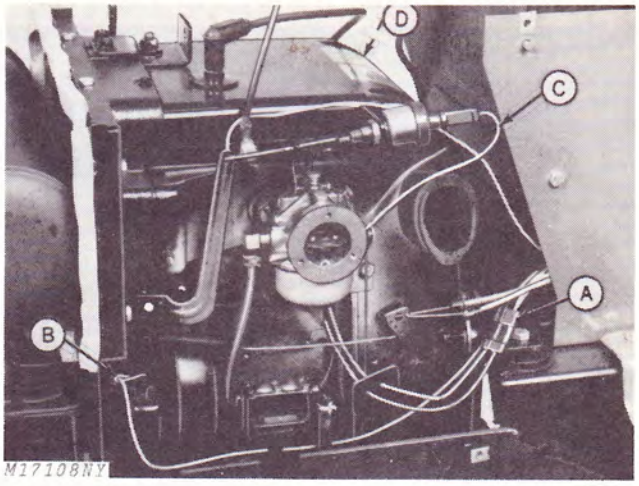
Disconnect choke cable (C).

Close fuel strainer located under fuel tank.

Loosen clamp (D).

Remove fuel line (E) from fuel pump (F).

Disconnecting Wiring



A—Engine Wiring Harness
B—PTO Clutch Lead
C—Anti-Dieseling Solenoid Lead
D—Starter Cable

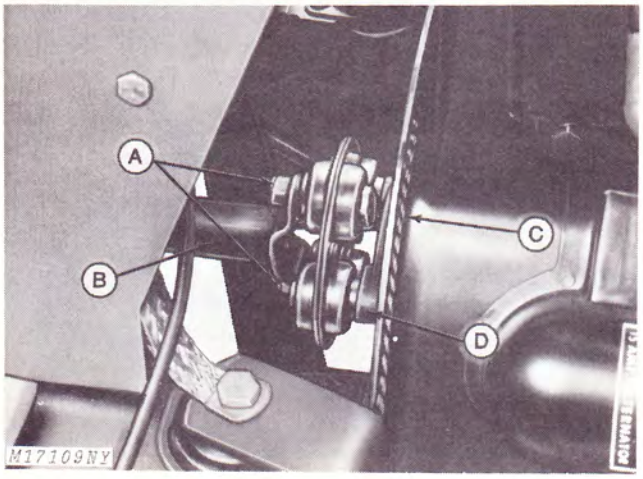
Fig. 11-Disconnecting Wiring—K341AQS Engine Illustrated

On 300 and 316 Tractors, disconnect engine wiring harness (A), electric PTO clutch lead (B) anti-dieseling solenoid lead (C) and starter cable (D).

NOTE: 312 Tractors are not equipped with anti-dieseling solenoid lead (C).

Disconnect engine wiring harness (A), electric PTO clutch lead (B) and starter cable (D) on 312 and 314 Tractors.

Disconnecting Drive Shaft on 300 Tractor (Serial No. 30,001-70,000)



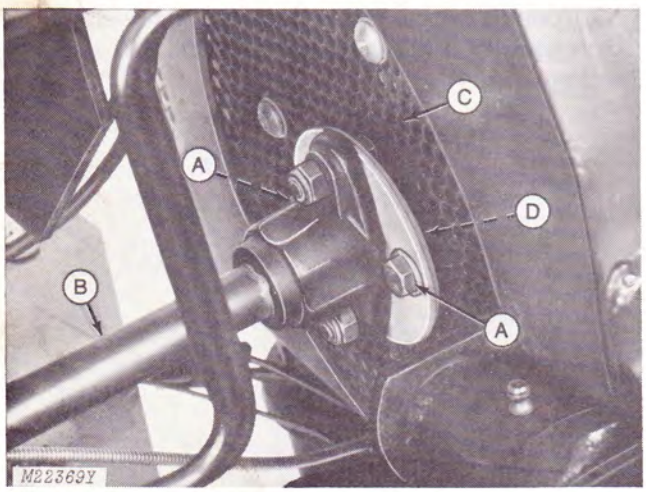
A—Cap Screws and Nuts
B—Drive Shaft
C—Intake Screen
D—Drive Hub

Fig. 12-Disconnecting Drive Shaft on 300 Tractors (Serial No. 30,001-70,000)

Remove two cap screws and nuts (A), Fig. 12. Disconnect drive shaft from engine.

NOTE: Remove drive hub (D) and intake screen (C) after engine has been removed, Fig. 14.

Disconnecting Drive Shaft on 300 Tractors (Serial No. 70,001-80,000) and All 312, 314 and 316 Tractors



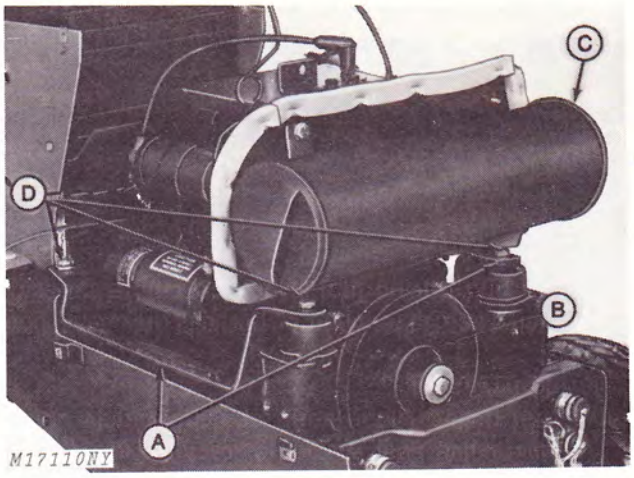
A—Cap Screws
B—Drive Shaft
C—Intake Screen
D—Drive Hub

Fig. 13-Disconnecting Drive Shaft on 300 Tractors (Serial No. 70,001-80,000) and all 312 and 316 Tractors

Remove two cap screws (A) and disconnect drive shaft (B) from drive hub (D).

NOTE: Remove intake screen (C) and drive hub (D) after engine has been removed, Fig. 14.

Removing Engine



A—Engine Mounts
B—Electric PTO Clutch
C—Muffler
D—Cap Screws and Nuts

Fig. 14-Removing Engine - 300 and 316 Tractor Illustrated

Remove four cap screws and nuts (D), Fig. 14.

Lift engine from tractor frame with a hoist.

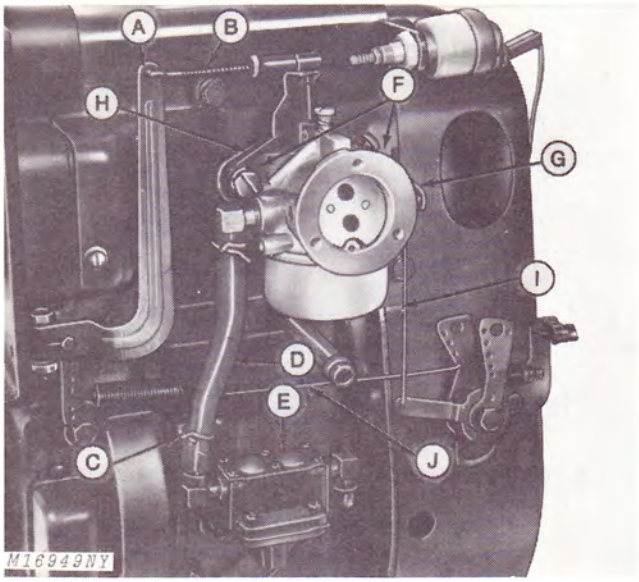
Remove engine mounts (A).

Remove electric PTO clutch (B). See Section 40.

Remove muffler (C).

DISASSEMBLY

Removing Carburetor



A—E-Ring
B—Governor Rod
C—Clamp
D—Fuel Line
E—Fuel Pump
F—Screws
G—Carburetor
H—Gasket
I —Choke Link
J —Governor Spring

Fig. 15-Removing Carburetor—K341AQS Engine Illustrated

Remove E-ring (A) to disconnect governor rod (B), Fig. 15.

Loosen clamp (C) and disconnect fuel line (D) from fuel pump (E).

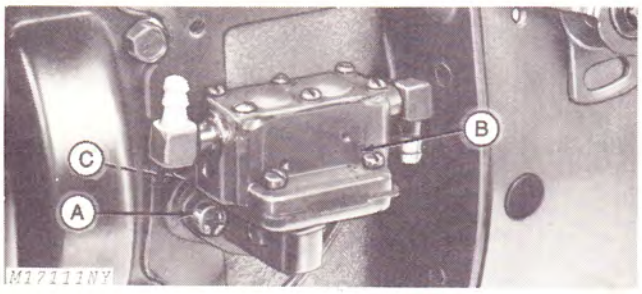
Remove carburetor mounting screws (F).

Remove carburetor (G) and gasket (H).

Remove choke link (I).

Remove governor spring (J).

Removing Fuel Pump

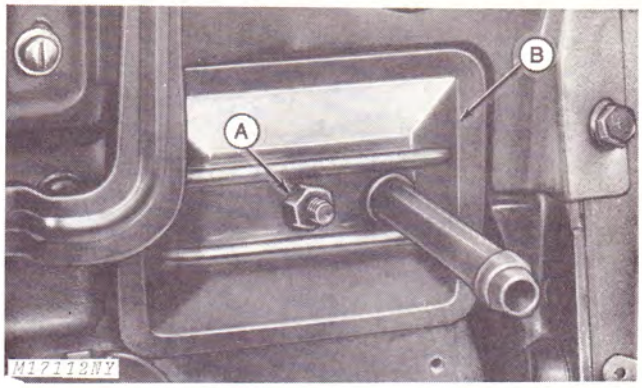


A—Screws **B—Fuel Pump** **C—Gasket**

Fig. 16-Removing Fuel Pump

Remove screws (A), fuel pump (B) and gasket (C).

Removing Breather



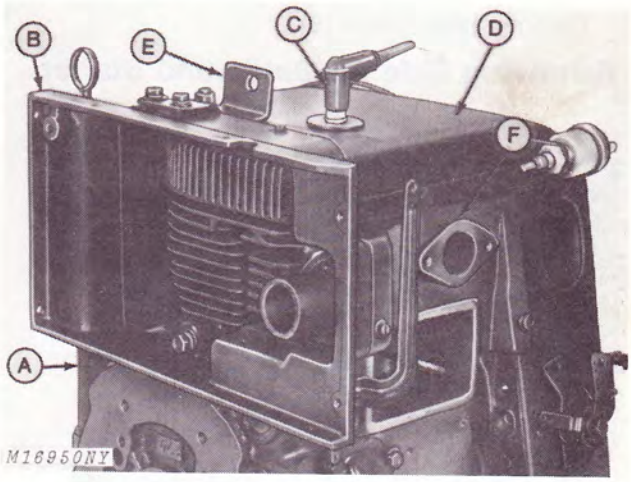
A—Nut and Lock Washer **B—Breather Assembly**

Fig. 17-Removing Breather—K341AQS Engine Illustrated

Remove nut and lock washer (A), Fig. 17.

Remove breather assembly (B).

Removing Air Duct and Baffles on 300, 314 and 316 Tractors



A—Oil Fill Tube
B—Air Duct
C—Spark Plug
D—Head Baffle
E—Lift Strap
F—Side Air Baffle

Fig. 18-Removing Air Duct and Baffle

NOTE: Oil fill tube (A) must be removed to reach screw holding air duct (B).

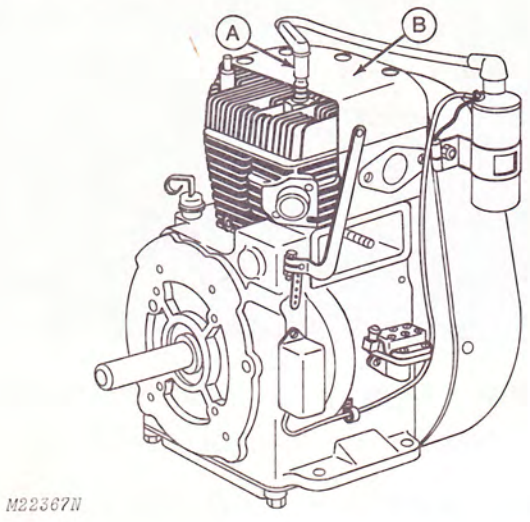
Remove air duct (B), Fig. 18.

Remove spark plug (C).

Remove head baffle (D) and lift strap (E).

Remove side air baffle (F).

Removing Spark Plug and Head Baffle on 312 Tractor

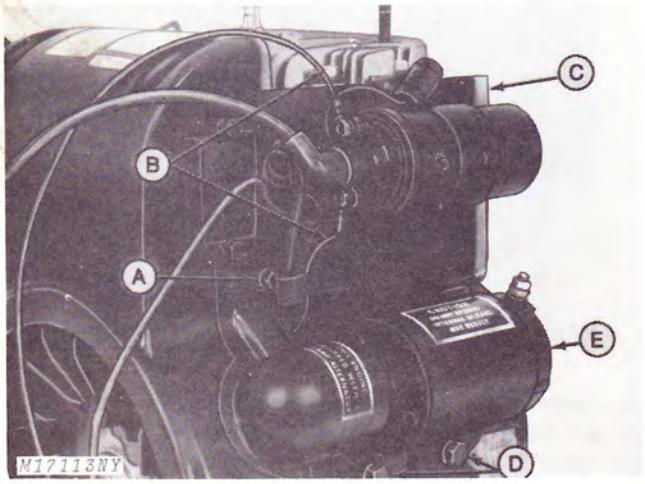


A—Spark Plug **B—Head Baffle**

Fig. 19-Removing Spark Plug and Head Baffle

Remove spark plug (A), Fig. 19.
Remove head baffle (B).

Removing Side Air Baffle and Starter

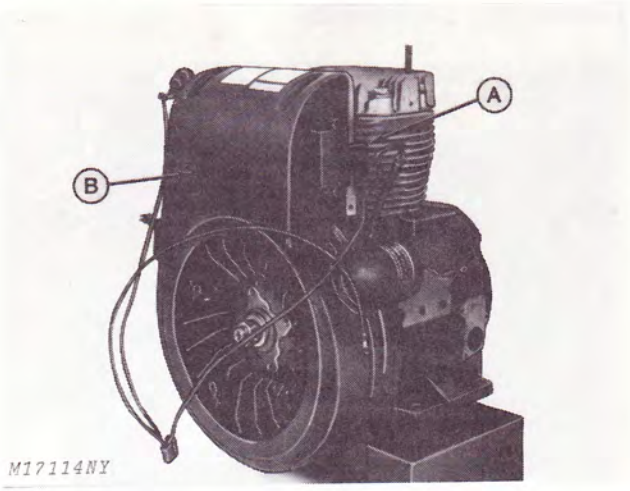


A—Cap Screw
B—Coil Leads
C—Side Air Baffle
D—Screws
E—Starter

Fig. 20-Removing Side Air Baffle and Starter - K341AQS Engine Illustrated

Disconnect coil leads (B), Fig. 20.
Remove cap screw (A).
Remove side air baffle (C).
Remove screws (D).
Remove starter (E).

Removing Blower Housing



A—Wiring Harness **B—Blower Housing**

Fig. 21-Removing Blower Housing - K341AQS Engine Illustrated

Disconnect wiring harness (A), Fig. 21.

Remove blower housing (B).

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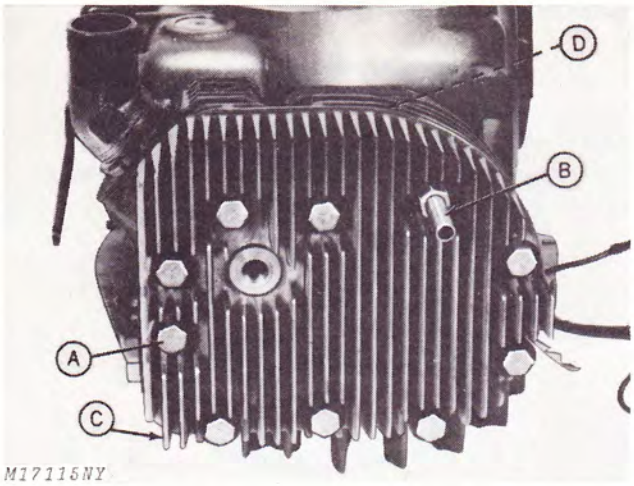
Removing Cylinder Head



A—Cylinder Head Bolt **C—Cylinder Head**
B—Cylinder Head Nut **D—Cylinder Head Gasket**

Fig. 22-Removing Cylinder Head—K341AQS Engine Illustrated

Remove cylinder head bolts (A) and nut (B), Fig. 22.

Remove cylinder head (C) and gasket (D).

Removing Cylinder Ridge

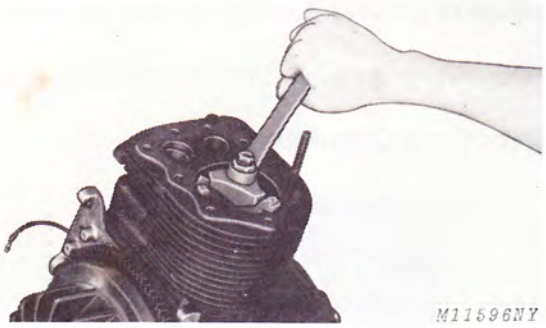


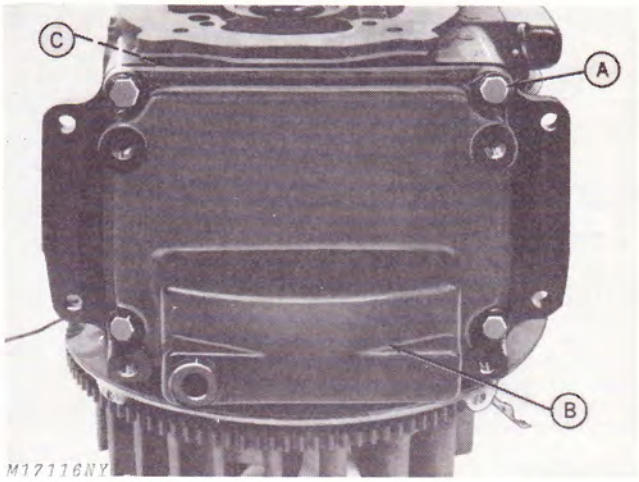
Fig. 23-Removing Cylinder Ridge

As the cylinder wears, a ridge is found above the ring travel zone. This ridge must be removed before the piston is removed to prevent piston land damage.

Position piston at bottom of its stroke and remove cylinder ridge with a ridge reamer, Fig. 23.

IMPORTANT: Do not cut into the ring travel zone when removing the cylinder ridge.

Removing Oil Pan



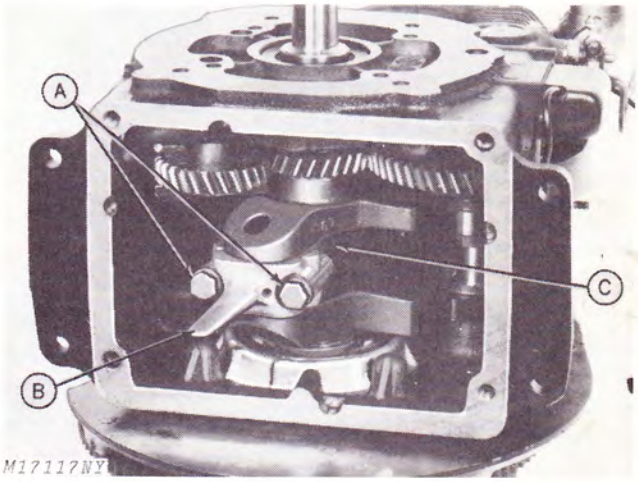
A—Cap Screws and Lock Washers B—Oil Pan C—Gasket

Fig. 24-Removing Oil Pan—K341AQS Engine Illustrated

Remove cap screws and lock washers (A), Fig. 24.

Remove oil pan (B) and gasket (C).

Removing Piston



A—Cap Screws **B—Cap** **C—Connecting Rod**

Fig. 25-Removing Piston—K341AQS Engine Illustrated

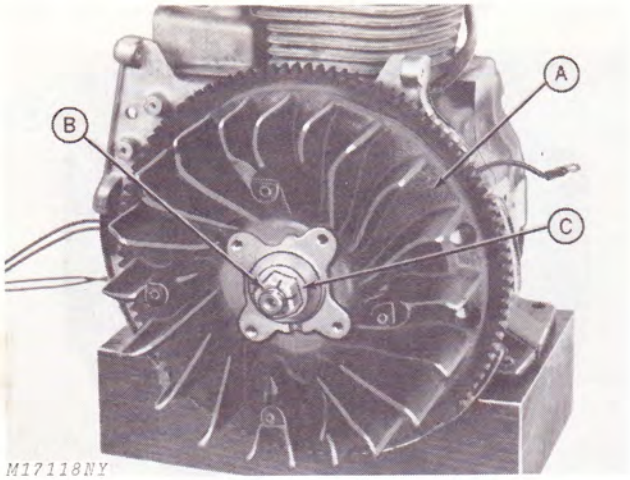
Remove cap screws (A), Fig. 25.

Remove cap (B).

Push connecting rod (C) and piston out top of cylinder bore.

DISASSEMBLY—Continued

Removing Flywheel



A—Flywheel **B—Nut** **C—Washer**

Fig. 26-Removing Flywheel Nut

Hold flywheel (A) with either a bar between the fins or with a strap wrench.

Remove nut (B) with a socket and breaker bar.

Remove washer (C).

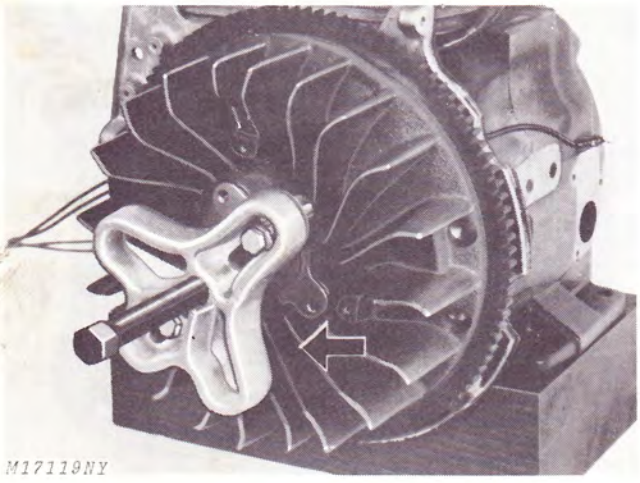
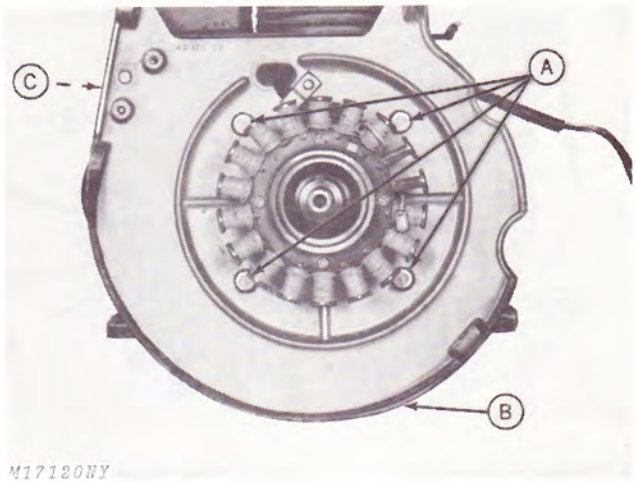


Fig. 27-Removing Flywheel

Remove flywheel with a JDM-68 Flywheel Puller Fig. 27.

Remove flywheel key.

Removing Bearing Plate



A—Cap Screws **B—Bearing Plate** **C—Gaskets**

Fig. 28-Removing Bearing Plate

Remove cap screws (A), Fig. 28.

Carefully tap bearing plate (B) off crankshaft, using a soft mallet.

IMPORTANT: Tap carefully, moving from side-to-side to prevent damage to bearing plate.

Remove gaskets (C) from behind bearing plate.

Removing Crankshaft

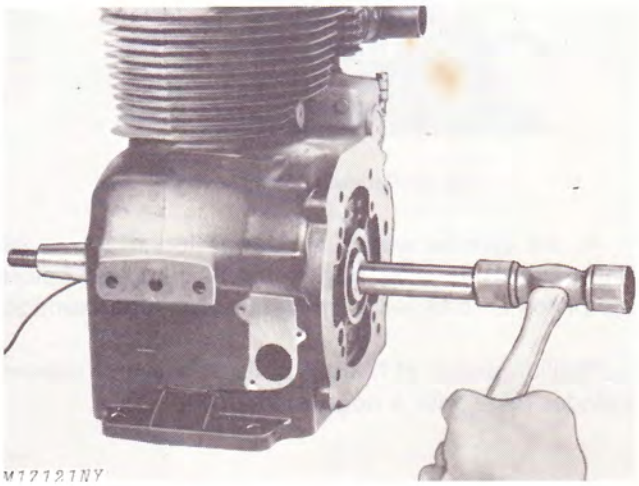
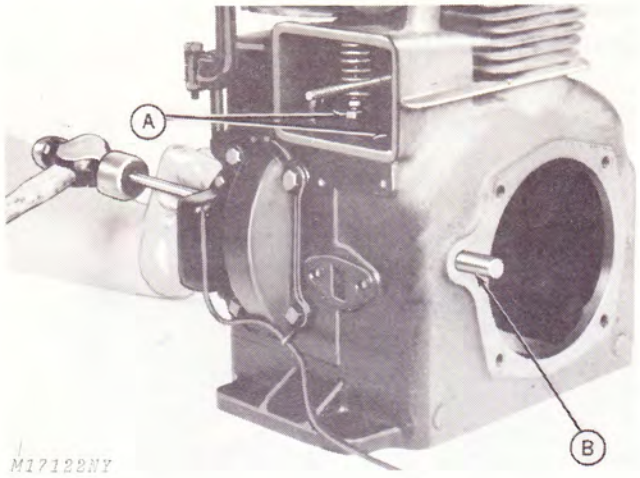


Fig. 29-Removing Crankshaft

Tap crankshaft out of flywheel side of engine with a large soft mallet, Fig. 29.

Removing Camshaft

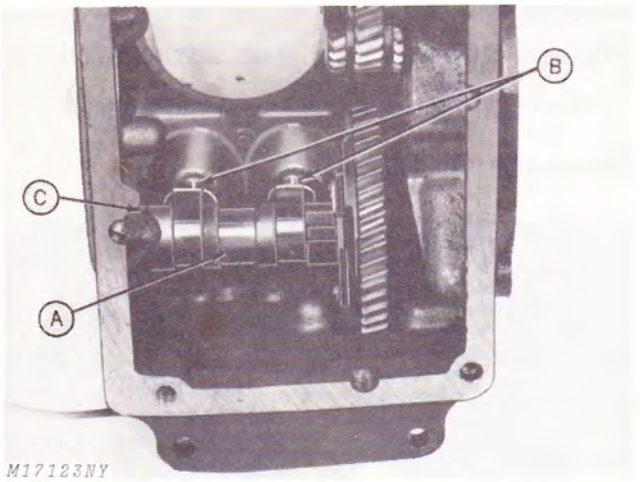


A—Tappets **B—Camshaft Pin**

Fig. 30-Removing Camshaft Pin

NOTE: Mark tappets (A) so they can be re-installed in the same tappet guides.

Drive camshaft pin (B) out flywheel side of engine with a hammer and drift punch, Fig. 30.



A—Camshaft **B—Tappets** **C—Spacer Washer**

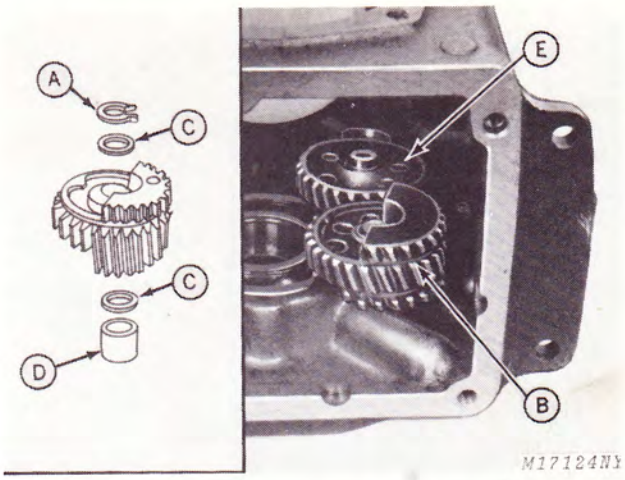
Fig. 31-Removing Camshaft

Remove camshaft (A), Fig. 31.

Remove tappets (B).

NOTE: Watch for and save spacer washer (C) or washers when removing camshaft.

Removing Balance Gears on 300 Tractors (Serial No. 30,001-73,244)



A—Snap Ring **D—Spacer**
B—Lower Balance Gear **E—Upper Balance Gear**
C—Shim

Fig. 32-Removing Balance Gears on K341AQS Engine

NOTE: 300 Tractors (Serial No. 73,245 and above) and all 312, 314 and 316 Tractor engines do not have balance gears on original equipment engines. However, replacement short blocks are equipped with balance gears.

Remove snap ring (A), Fig. 32.

Remove lower balance gear (B).

Remove shims (C) and spacer (D).

Repeat procedure for upper balance gear (E).

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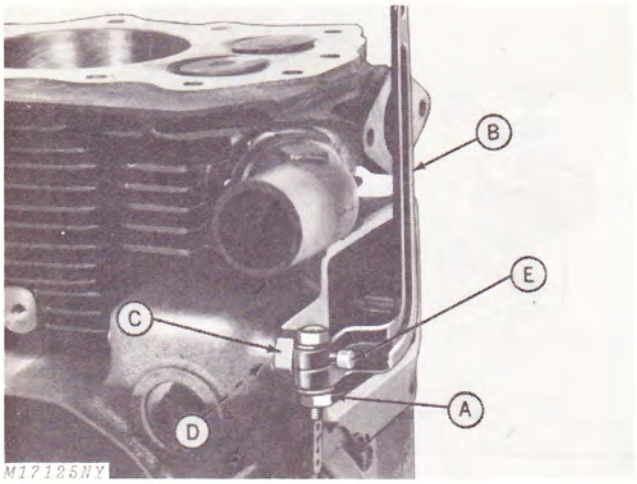
DISASSEMBLY—Continued

Removing Governor



A—Nut **C—Bushing** **E—Governor Shaft**
B—Governor Lever **D—Spacer**

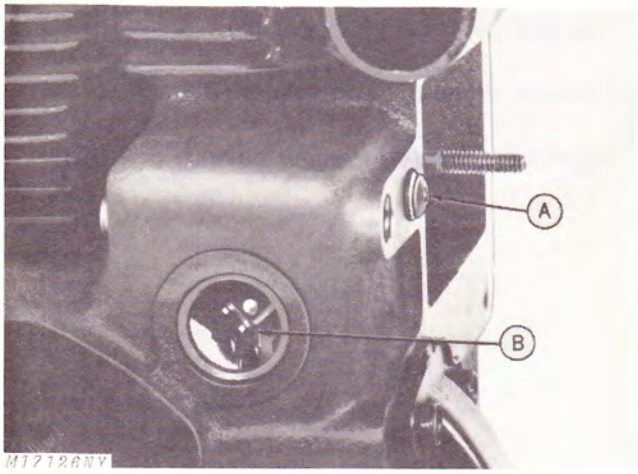
Fig. 33-Removing Governor Shaft

Loosen nut (A), Fig. 33.

Remove governor lever (B).

Remove bushing (C).

Remove governor shaft (E) and spacer (D) from inside of cylinder block.



A—Stop Pin and Washer **B—Governor Assembly**

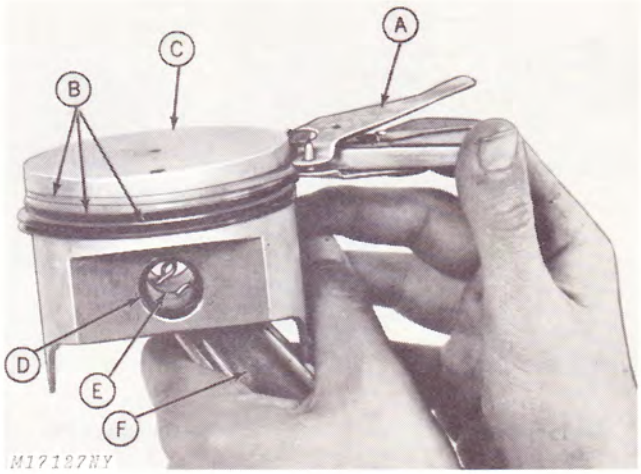
Fig. 34-Removing Governor Assembly (Welsch Plug Removed for Visibility)

Remove stop pin and washer (A), Fig. 34.

Remove governor (B) from inside cylinder block.

NOTE: Be careful not to lose thrust washer behind governor assembly.

Removing Piston Rings and Connecting Rod



A—JDM-49 Ring Expander **D—Retainer**
B—Rings **E—Piston Pin**
C—Piston **F—Connecting Rod**

Fig. 35-Removing Piston Rings and Connecting Rod

Use JDM-49 Ring Expander (A) to remove piston rings, Fig. 35.

Remove retainer (D) from each side of piston (C).

Remove piston pin (E) and connecting rod (F).

Removing Oil Seals

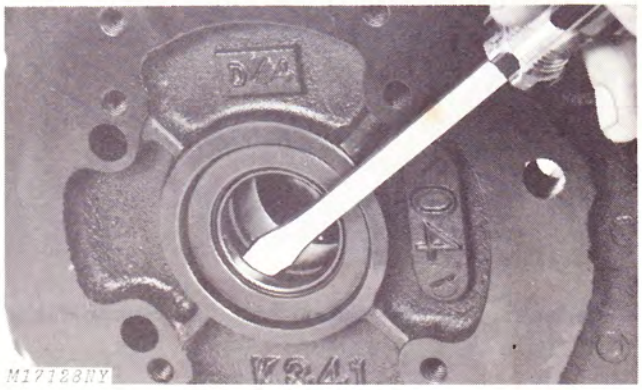


Fig. 36-Removing Oil Seals (Cylinder Block Seal Shown)

Remove oil seals from cylinder block and bearing plate with a screwdriver, Fig. 36.

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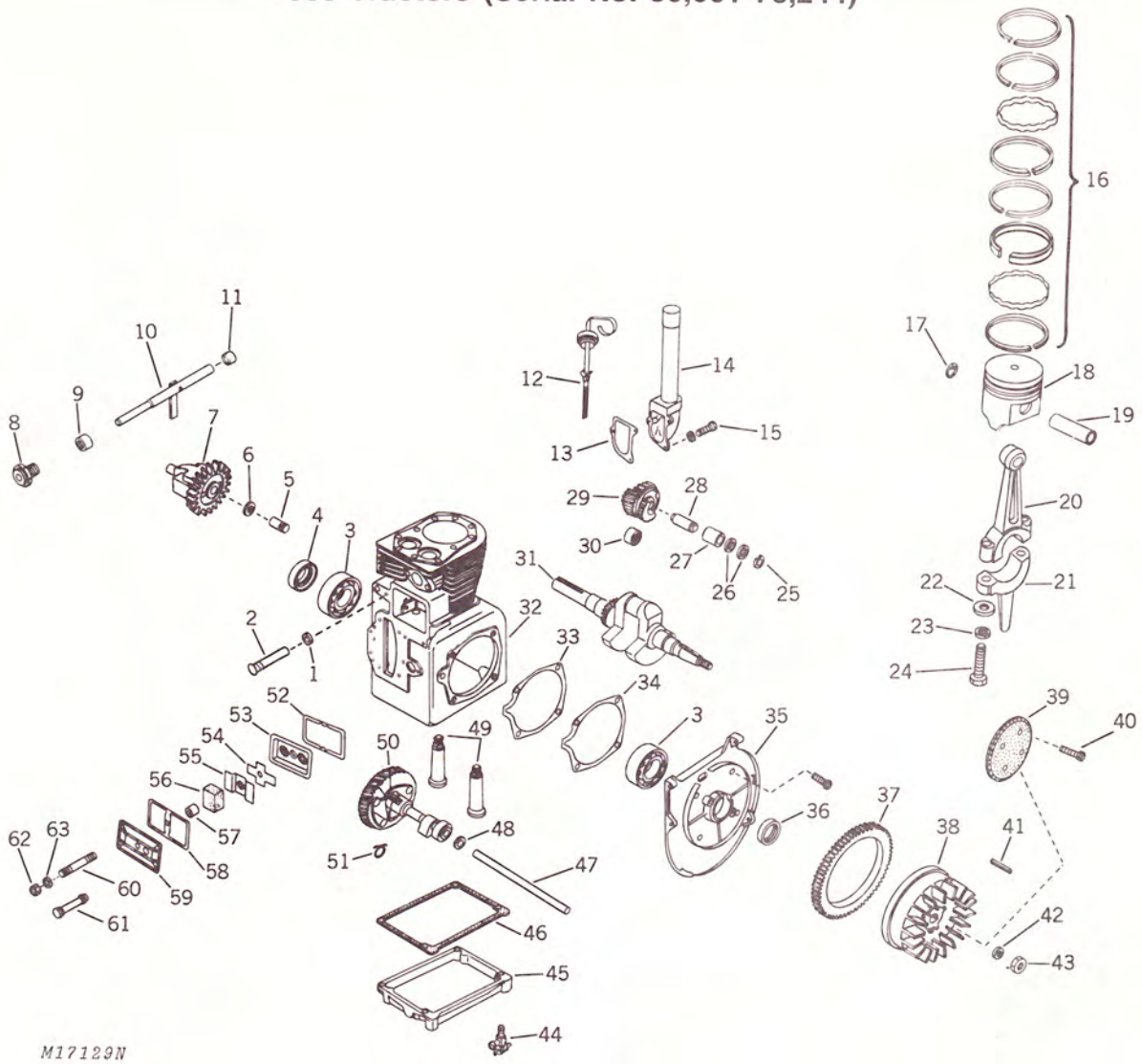
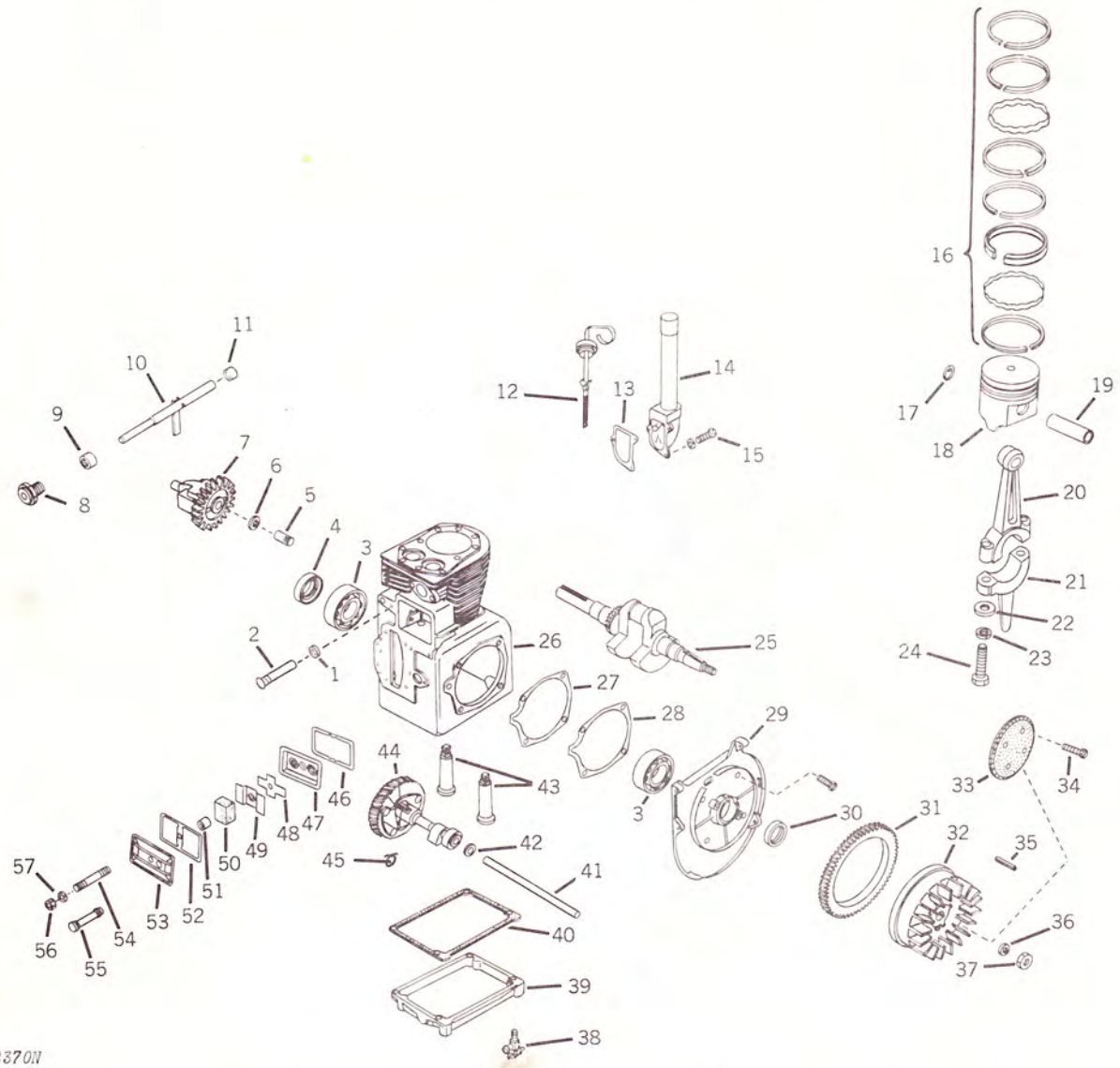
INSPECTION AND REPAIR
300 Tractors (Serial No. 30,001-73,244)



1—Washer
2—Stop Pin
3—Main Bearing (2 used)
4—Rear Oil Seal
5—Governor Gear Stub
6—Thrust Washer
7—Governor Gear
8—Bushing
9—Spacer
10—Governor Shaft
11—Needle Bearing
12—Dipstick
13—Oil Fill Tube Gasket
14—Oil Fill Tube
15—Screw and Washer (3 used)
16—Piston Ring Set
17—Retainer (2 used)
18—Piston
19—Piston Pin
20—Connecting Rod
21—Connecting Rod Cap
22—Flat Washer (2 used)
23—Lock Washer (2 used)
24—Cap Screw (2 used)
25—Retaining Ring (2 used)
26—Spacer Washers (as required)
27—Spacer (2 used)
28—Balance Gear Stub (2 used)
29—Balance Gear (2 used)
30—Needle Bearing (2 used)
31—Crankshaft
32—Cylinder Block
33—Gasket
34—Gasket (as required)
35—Bearing Plate
36—Front Oil Seal
37—Ring Gear
38—Flywheel
39—Air Intake Screen
40—Cap Screw (4 used)
41—Flywheel Key
42—Flat Washer
43—Flywheel Nut
44—Drain Valve
45—Oil Pan
46—Gasket
47—Camshaft Pin
48—Spacer Washer (as required)
49—Lifter (2 used)
50—Camshaft
51—ACR Spring
52—Gasket
53—Plate
54—Reed
55—Baffle
56—Filter
57—Seal
58—Gasket
59—Cover
60—Stud
61—Hose
62—Nut
63—Lock Washer

Fig. 37-Exploded View of Kohler K341AQS Engine (Serial No. -7597672)

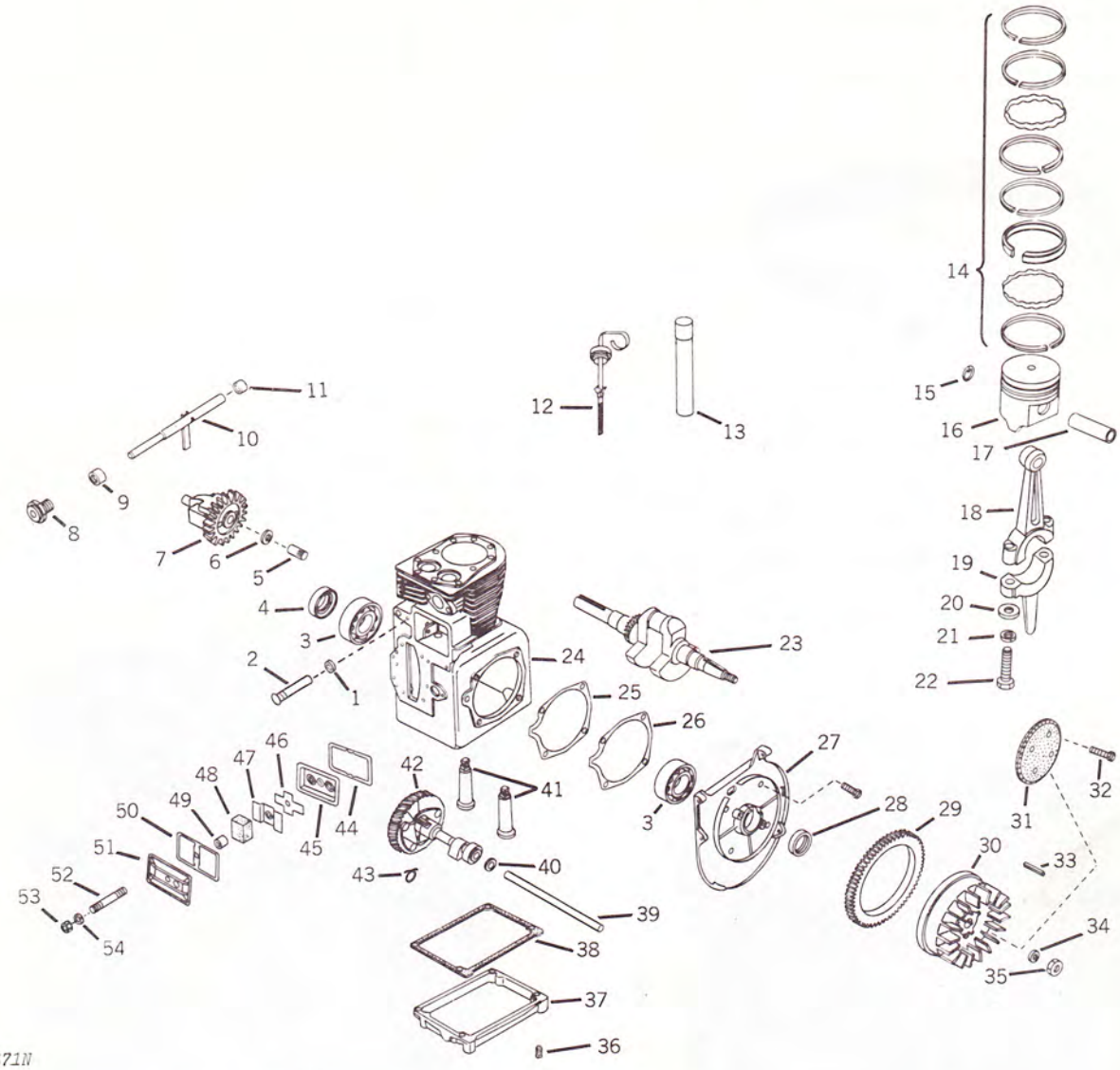
INSPECTION AND REPAIR
300 Tractors (Serial No. 73,245-), 314 and 316 Tractors



1—Washer
2—Stop Pin
3—Main Bearing (2 used)
4—Rear Oil Seal
5—Governor Gear Stub
6—Thrust Washer
7—Governor Gear
8—Bushing
9—Spacer
10—Governor Shaft
11—Needle Bearing
12—Dipstick
13—Oil Fill Tube Gasket
14—Oil Fill Tube
15—Screw and Washer (3 used)
17—Retainer (2 used)
18—Piston
19—Piston Pin
20—Connecting Rod
21—Connecting Rod Cap
22—Flat Washer (2 used)
23—Lock Washer (2 used)
24—Cap Screw (2 used)
25—Crankshaft
26—Cylinder Block
27—Gasket
28—Gasket (as required)
29—Bearing Plate
30—Front Oil Seal
31—Ring Gear
32—Flywheel
33—Air Intake Screen
34—Cap Screw (4 used)
35—Flywheel Key
36—Flat Washer
37—Flywheel Nut
38—Drain Valve
39—Oil Pan
40—Gasket
41—Camshaft Pin
42—Spacer Washer (as required)
43—Lifter (2 used)
44—Camshaft
45—ACR Spring
46—Gasket
47—Plate
48—Reed
49—Baffle
50—Filter
51—Seal
52—Gasket
53—Cover
54—Stud
55—Hose
56—Nut
57—Lock Washer

Fig. 38-Exploded View of Kohler K341AQS Engine (Serial No. 7597673-) and K321AQS Engine

INSPECTION AND REPAIR
312 Tractor



1—Washer
2—Stop Pin
3—Main Bearing (2 used)
4—Rear Oil Seal
5—Governor Gear Stub
6—Thrust Washer
7—Governor Gear
8—Bushing
9—Spacer
10—Governor Shaft
11—Needle Bearing
12—Dipstick
13—Oil Fill Tube
14—Piston Ring Set
15—Retainer (2 used)
16—Piston
17—Piston Pin
18—Connecting Rod
19—Connecting Rod Cap
20—Flat Washer (2 used)
21—Lock Washer (2 used)
22—Cap Screw (2 used)
23—Crankshaft
24—Cylinder Block
25—Gasket
26—Gasket (as required)
27—Bearing Plate
28—Front Oil Seal
29—Ring Gear
30—Flywheel
31—Air Intake Screen
32—Cap Screw (4 used)
33—Flywheel Key
34—Flat Washer
35—Flywheel Nut
36—Drain Plug
37—Oil Pan
38—Gasket
39—Camshaft Pin
40—Spacer Washer (as required)
41—Lifter (2 used)
42—Camshaft
43—ACR Spring
44—Gasket
45—Plate
46—Reed
47—Baffle
48—Filter
49—Seal
50—Gasket
51—Cover
52—Stud
53—Nut
54—Lock Washer

Fig. 39-Exploded View of Kohler K301AS Engine

INSPECTION AND REPAIR—Continued

NOTE: Pistons shown under inspection and repair are sample pistons and may not look exactly like the K341AQS or K301AS engine piston.

Analyzing Piston Ring Wear

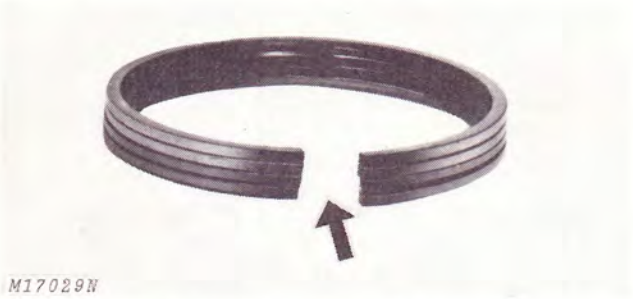


Fig. 40-Piston Rings in Alignment

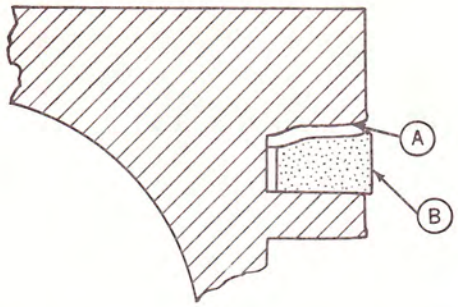
Rings of the wrong size or rings having improper end gap cannot conform to the shape of the cylinder. This results in high oil consumption and excessive blowby. This could also be caused by end gaps being in alignment, Fig. 40. Ring end gaps should be staggered.

Fig. 41-Scored Piston and Rings Caused by Overheating as Temperatures Reach Melting Point of the Materials

Light scuffing or scoring of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of piston material, Fig. 41.

When this condition is found, check and correct the following probable causes:

1. Cooling fins on block and head plugged with dirt.
2. Lack of cylinder lubrication.
3. Improper combustion.
4. Wrong bearing or piston clearance.
5. Too much oil in crankcase causing fluid friction.



A—Ring Groove Wear **B—Top Ring Wear**

Fig. 42-Top Ring and Groove Side Wear

Check wear of ring grooves carefully, Fig. 42, especially the top groove. The top ring and groove is exposed to most combustion temperature and pressure as well as airborne abrasives which enter the combustion chamber.

Fig. 43-Piston Rings Stuck and Broken Because of Lacquer, Varnish and Carbon Build-Up

Any condition which causes the engine to operate at abnormally high temperatures may cause varnish and lacquer gum deposits, Fig. 43. Carbon deposits may also form in the piston grooves, causing the rings to stick. When this happens, excessive oil consumption and blowby will occur.

Engine heating and ring sticking are most often caused by:

1. Overloading.
2. Over-advanced ignition.
3. Lean fuel mixture.
4. Dirty cooling fins.
5. Incorrect oil.
6. Low oil supply.
7. Stale fuel.

Litho in U.S.A.

Fig. 44-Scratched Ring Faces Caused by Abrasives in the Engine

Vertical scratches across the faces of piston rings, Fig. 44, are the result of an abrasive entering the engine. Abrasives may be airborne, may have been left in during overhaul, or may be loose lead carbon deposits.

When this condition is found, always check and correct the source of abrasives to prevent premature ring failure.

Common causes for abrasives in the engine are:

1. Damaged, collapsed or improperly installed air filter.

2. Loose connection or damaged gasket between air filter and carburetor.

3. Air leak around carburetor-to-cylinder block gasket.

4. Air leakage around throttle shaft.

5. Failure to properly clean cylinder bore during overhaul.

Fig. 45-Worn Oil Rings Which Cannot Provide Oil Control

Rails of the oil ring are worn down to the oil drain hole spacer and the ring surface is worn flat, Fig. 45. This can come from cylinder wall contact after much use and possible entry of abrasives. Compression rings will also be worn thin.

Badly worn oil rings will have:

1. Extra large gap.

2. Low tension.

Inspecting Piston

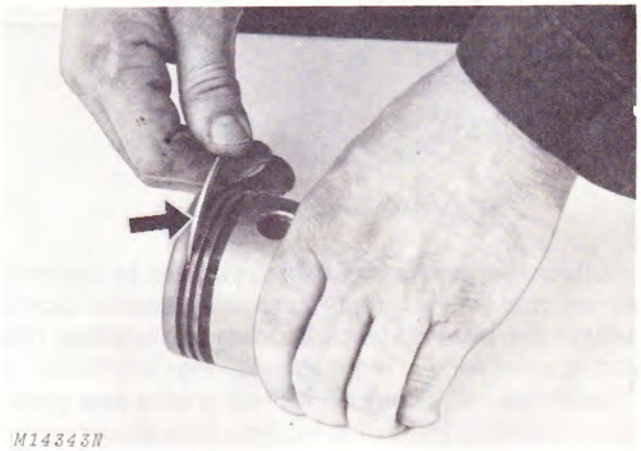


Fig. 46-Cleaning Ring Grooves

Remove deposits from piston surfaces. Clean gum and varnish from the piston skirt.

IMPORTANT: Do not use a caustic solution or a wire brush to clean pistons.

Be sure the oil ring holes are clean.

Clean carbon from piston ring grooves with a ring groove cleaner. If a cleaning tool is not available, break an old ring and use it to clean groove, Fig. 46.

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INSPECTION AND REPAIR—Continued

Inspecting Piston—Continued

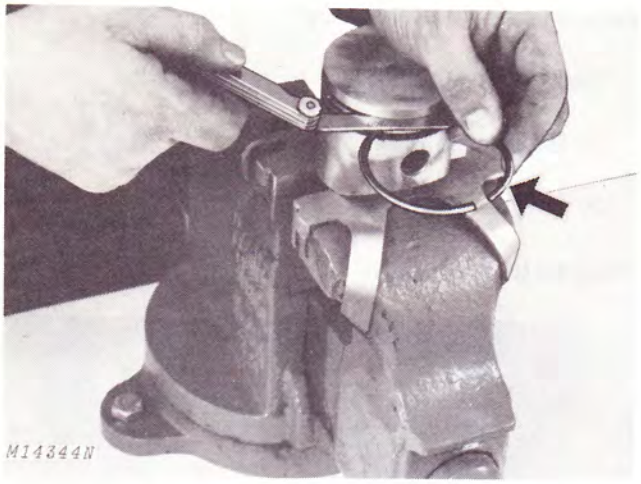
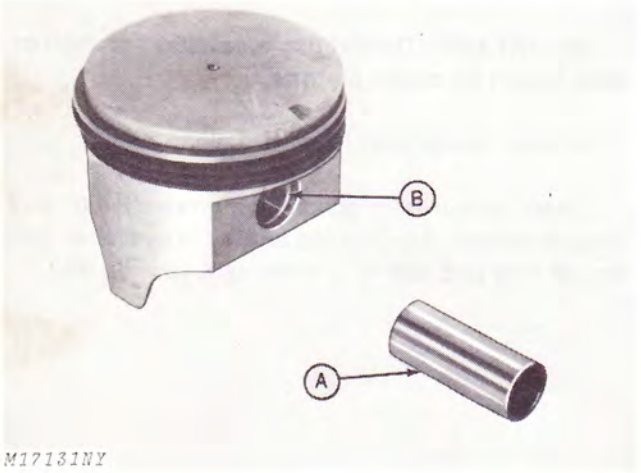


Fig. 47-Measuring Ring Clearance

Check ring grooves for excessive wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance between ring and groove with a feeler gauge, Fig. 47. Refer to "Specifications", Group 20 for ring groove side clearance. Replace piston having ring clearance beyond wear limits.

Inspect piston for fractures at the ring lands, skirts and ring bosses and for rough or scored skirts.



A—Piston Pin **B—Piston Pin Bearing Surface**

Fig. 48-Measuring Piston Pin and Piston Pin Bearing

Measure piston pin diameter with a JDM-57 Dial Caliper, Fig. 48. Measure piston pin bearing surface with a gauge from JDM-61 Telescoping Gauge Set. See Group 20 for piston-to-pin clearance dimensions.

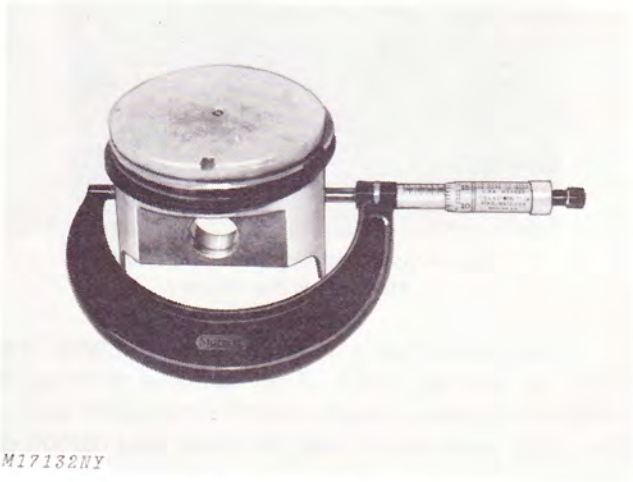


Fig. 49-Measuring Piston

Measure piston diameter with a micrometer, Fig. 49. Measure at the same height as the centerline of the piston pin bore and 90 degrees to the pin bore axis.

Measure cylinder bore diameter, see page 20-15-24, Fig. 68.

If piston-to-cylinder bore clearance is less than 0.005 inch over specifications, deglaze the cylinder walls, page 20-15-25, and install a set of heavy-duty rings.

If piston-to-cylinder bore clearance is more than 0.005 inch over specifications, the cylinder will have to be rebored and an oversize piston and rings installed.

Oversize pistons and rings are available in 0.010 inch (0.254 mm), 0.020 inch (0.508 mm) and 0.030 inch (0.762 mm) sizes for service.

See page 20-15-25 for deglazing and boring information.

Piston Analysis

Fig. 50-Piston Top Land Burning Caused by Detonation

Detonation, Fig. 50, is a form of abnormal combustion causing excessive temperature and pressure in the combustion chamber. It is commonly called carbon knock, spark knock or timing knock. Detonation occurs as compressed air-fuel mixture ignites spontaneously to interrupt the normal ignition flame front. When detonation is detected, check and correct the following possible causes:

1. Lean fuel mixtures.
2. Low octane fuels.
3. Over-advanced ignition timing.
4. Engine lugging.
5. Build-up of carbon deposits on piston and cylinder head causing excessive compression.
6. Wrong cylinder head or milling of head increasing compression ratio.

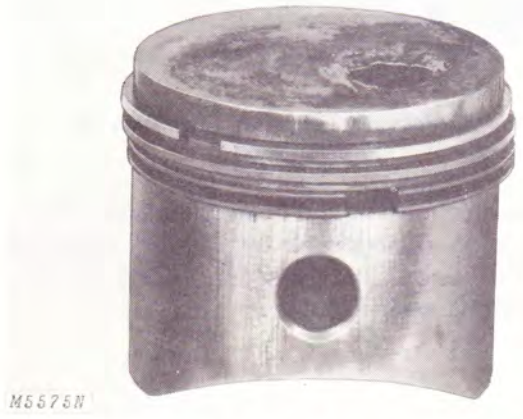


Fig. 51-Hole Burned in Piston Caused by Pre-Ignition

Pre-ignition is the igniting of the fuel-air mixture prior to the regular ignition spark. Pre-ignition causes severe internal shock resulting in pings, vibration, detonation and power loss. Severe damage to piston, rings and valves results from pre-ignition, Fig. 51.

When pre-ignition is suspected and detected, check and correct the following possible causes:

1. Internal carbon deposits which remain incandescent.
2. Incorrect spark plug (high heat range).
3. Broken ceramic in spark plug.
4. Sharp edges on valves or elsewhere in the combustion chamber.

Fig. 52-Diagonal Piston Wear Pattern Caused by Bent or Twisted Connecting Rod

Check rod and piston alignment when a piston shows a diagonal wear pattern extending across the skirt of the piston, Fig. 52. Contact with cylinder wall shows on bottom of skirt at left and ring lands on the right.

A cylinder bored at an angle to the crankshaft could also cause improper ring contact with the cylinder wall.

This condition can cause:

1. Rapid and uneven piston wear.
2. Rapid piston ring wear.
3. Excessive oil consumption.

INSPECTION AND REPAIR—Continued

Piston Analysis—Continued

Fig. 53-Piston Damage Caused by Piston Pin Retainer Coming Loose

In Fig. 53, a piece of the piston pin retainer found its way into the oil ring.

Pin retainers loosen or break due to:

1. Rod misalignment.
2. Excessive crankshaft end play.
3. Crank pin taper.
4. Weak pin retainers.
5. Pin retainers incorrectly installed.

Inertia can cause the retainer or loose object inside the piston pin to beat out the piston and cylinder in the pin boss area. Damage to both piston and cylinder occurs.

Inspecting Crankshaft

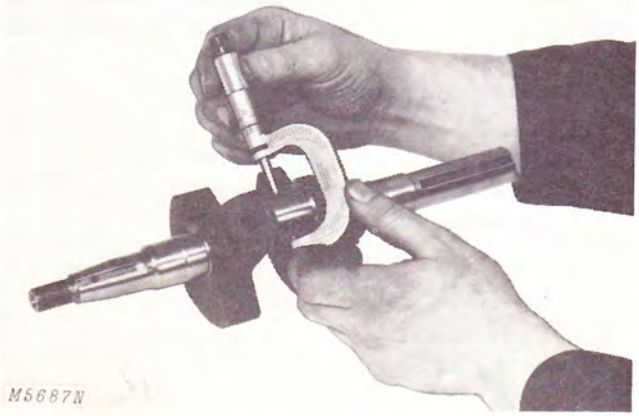


Fig. 54-Measuring Crankshaft Journal

Wipe crankshaft dry and check general condition. Clean up threads on end of shaft if necessary. If crankshaft journal, Fig. 54, indicates wear beyond specified limits or if journal is scored, take the crankshaft to a competent automotive shop to turn the journal down 0.010 inch (0.254 mm). An undersize connecting rod and cap must then be installed.

IMPORTANT: Do not just replace a crankshaft having a bad journal. Turning down the journal and installing a new rod will likely be the least expensive method of repair.

Inspecting Connecting Rod and Cap

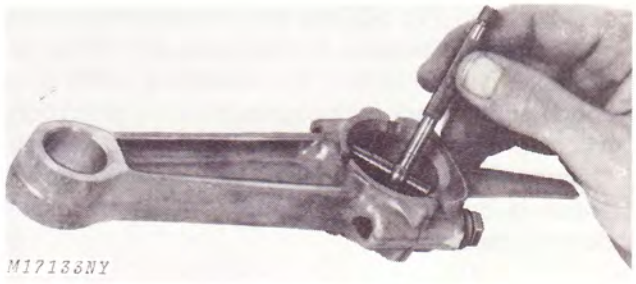


Fig. 55-Measuring Connecting Rod Crankshaft Bearing Surface

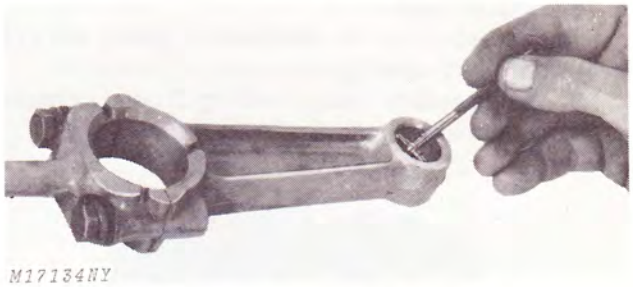
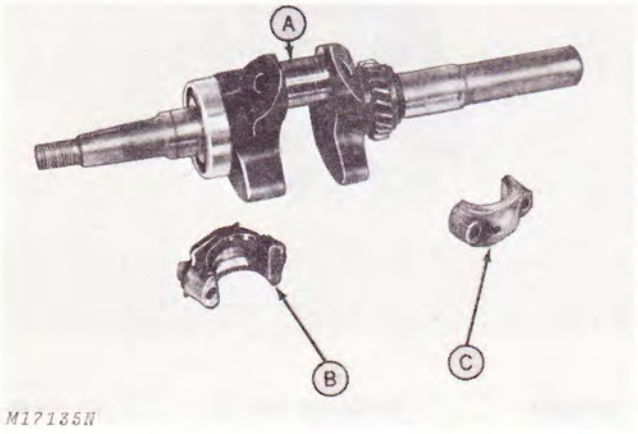


Fig. 56-Measuring Connecting Rod Piston Pin Bearing Surface

Measure connecting rod bearing surfaces, Figs. 55 and 56, using a gauge from the JDM-61 Telescoping Gauge Set. See "Specifications", Group 20, for dimensions and wear tolerances.

Analyzing Crankshaft and Connecting Rod Wear

Clean and dry crankshaft and connecting rod. Check rod and cap for signs of bending, cracking or unusual wear patterns.



M17135N

A—Crankshaft Journal B—Broken Rod C—Damaged Cap

Fig. 57-Scored and Galled Crankshaft Journal and Rod Cap Caused by Lack of Lubrication

Lack of lubrication or improper lubrication can cause the connecting rod and cap to seize to the crankshaft. This may even cause rod particles to become embedded in the hardened steel crankshaft.

When the rod (B) and cap (C) seize to the crankshaft (A), the connecting rod and piston may both break with shattering force causing other interior damage. Should this happen, inspect block carefully for cracks and breakage before rebuilding engine.

Crankshaft and connecting rod damage can result from:

1. Engine run low on oil or without oil.
2. Oil slinger broken off bearing cap.
3. Oil hole in connecting rod plugged with sludge.
4. Oil not changed regularly.
5. Bearing cap installed incorrectly.

Note especially the condition of the rod and cap bearing area. Evidence of score marks on these areas indicates impurities in the oil or engine run without oil.

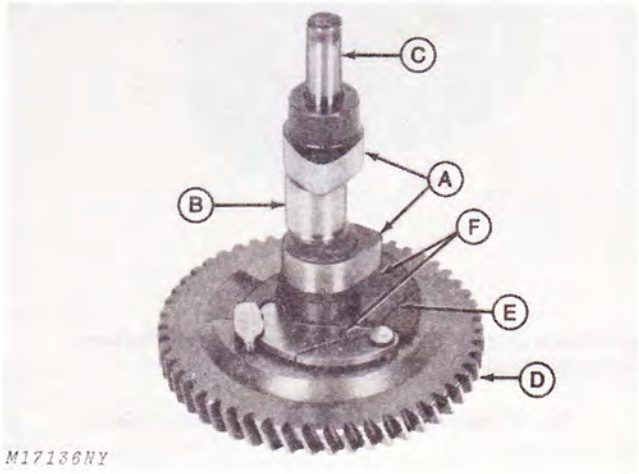
Replace rod showing scratch marks or deep scores in the bearing area. Bent rods can be straightened with a rod aligner. Be sure slinger on rod cap is intact — not cracked, bent or chipped. This is important.

NOTE: New rods and caps are available only as a matched set for service. If either is damaged, both must be replaced.

Measure fit of rod and cap to crankshaft bearing. Also measure fit of piston pin in connecting rod. See "Specifications", Group 20, for wear tolerances.

An undersize rod and cap (0.010 inch) is available for service.

Inspecting Camshaft



M17136NY

A—Cam Lobes
B—Fuel Pump Lobe
C—Pin
D—Gear
E—ACR Spring
F—ACR Weights

Fig. 58-Inspecting Camshaft

Inspect cam lobes (A) and fuel pump lobe (B) for wear, Fig. 58. Inspect gear (D) for worn or damaged teeth.

Install pin (C) in camshaft. Rotate camshaft to make sure pin is not extremely worn.

Make sure ACR spring (E) is installed exactly as shown and is not damaged or bent.

Check that ACR weights (F) pivot freely against spring (E) and that spring returns weights to the closed position.

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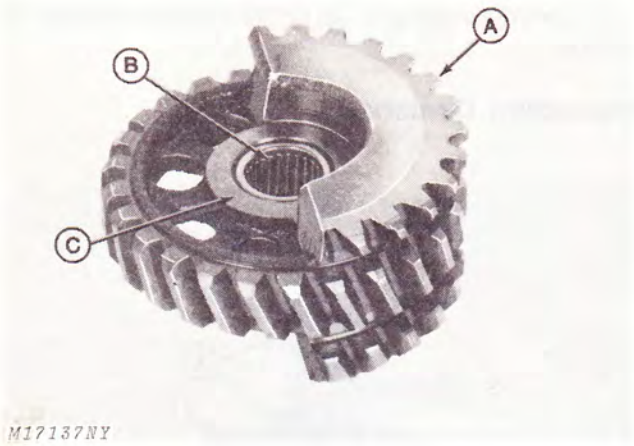
Inspecting and Repairing Balance Gears on 300 Tractors Serial No. 30,001-73,244



M17137NY

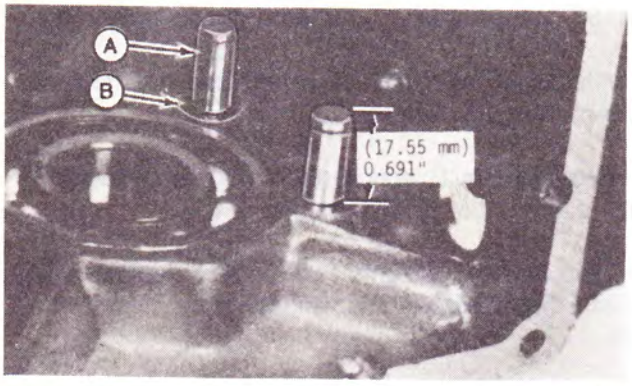
A—Balance Gear **C—Machined Surface**
B—Needle Bearing

Fig. 59-Inspecting K341AQS Engine Balance Gear

Inspect balance gears (A), Fig. 59, for chipped or damaged teeth.

Inspect needle bearings (B) for damage.

If needle bearings are damaged, drive old bearing out of balance gears. Press new bearing into balance gear until flush with machined surface (C) of balance gear.



M30382

A—Balance Gear Stub Shaft **B—Boss Area**

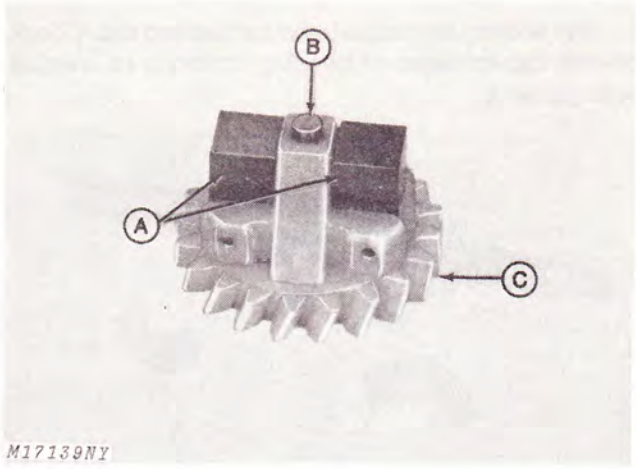
Fig. 60-Inspecting Balance Gear Stub Shafts

Inspect balance gear stub shafts (A), Fig. 60, for wear or damage.

If new stub shafts are required, drive stub shaft out of cylinder block.

Press new stub shaft into cylinder block until it extends 1.110 inch (28.2 mm) above boss area (B).

Inspecting Governor Components

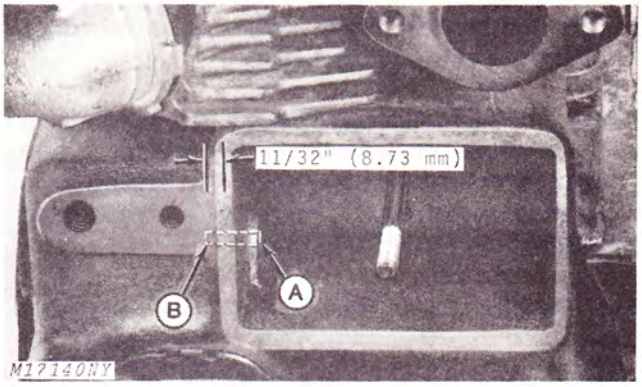


M17139NY

A—Weights **B—Center Pin** **C—Teeth**

Fig. 61-Inspecting Governor Gear

Make sure weights (A) and center pin (B) operate freely. Inspect governor gear teeth (C) for being chipped or damaged, Fig. 61.



M17140NY

A—Governor Gear Stub Shaft **B—Boss Area**

Fig. 62-Inspecting Governor Gear Stub Shaft

Inspect governor gear stub shaft (A) for wear or damage, Fig. 62. If a new stub shaft is required, drive stub shaft out of cylinder block. Press new stub shaft into cylinder block until it protrudes $^{11}/_{32}$ inch (8.73 mm) from boss area (B).

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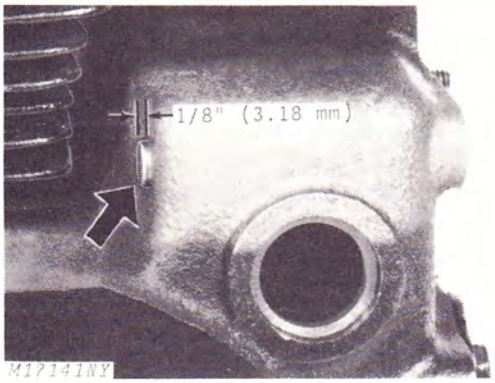


Fig. 63-Inspecting Governor Shaft Bearing

Inspect governor shaft bearing, Fig. 63, for damage. If a new bearing is required, drive old bearing out of cylinder block. Press new bearing into cylinder block. Let approximately 1/8 inch (3.18 mm) of bearing extend from cylinder block.

Inspecting Flywheel Ring Gear

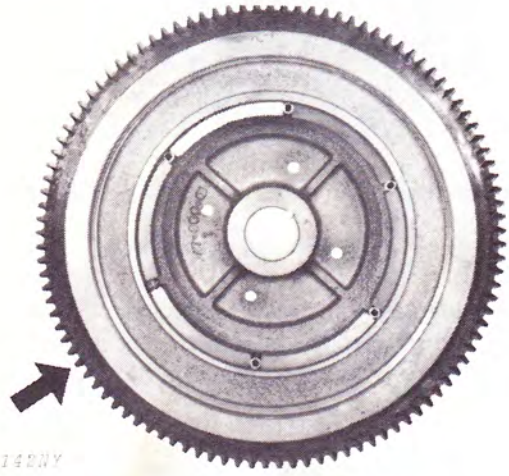


Fig. 64-Inspecting Flywheel Ring Gear

Inspect flywheel ring gear, Fig. 64, for broken, worn or damaged teeth. If ring gear is damaged, replace flywheel assembly.

Inspecting Main Bearings

Main bearings turn in an oil mist and will not normally require replacing. Check for unusual signs of wear such as race turning with bearing or bearing deflection caused by excessive engine lugging. Refer to "Bearing Analysis" below.

Bearing Analysis

The causes of bearing failure must be identified and understood in order to apply the proper corrective measures.

Fig. 65-Broken Races Caused by Misaligned Bearing During Installation

Bearings allowed to cock while inserting or pressing them over a burr may cause the bearing to crack, Fig. 65. Always use bearing driver tool and remove burrs before installing bearings.

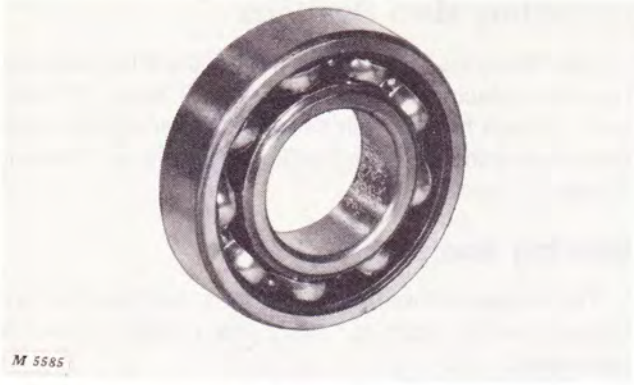


Fig. 66-Bearing Wear Caused by Crack or Looseness on Shaft

If inner ring is a loose fit on the rotating shaft, rotation of the shaft within the inner ring can scuff loose small particles of metal. These eventually get into the bearing causing wear on the balls and races. This makes for noisy operation, shortened bearing life, and premature failure. The condition is easily identified by scoring or abrasion on the bore of inner ring, Fig. 66.

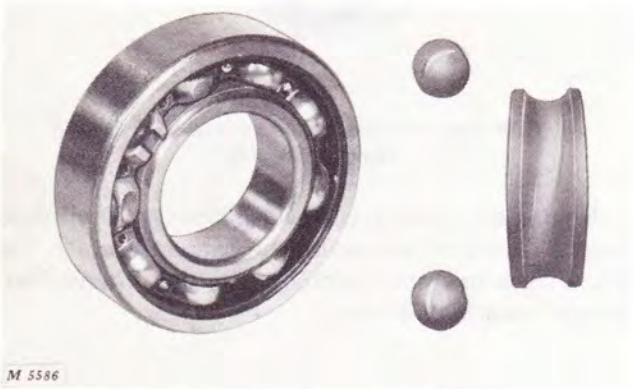


Fig. 67-Bearing Wear Caused by Misalignment

Misaligned bearings cause undue wear, heat by friction and eventual failure, Fig. 67.

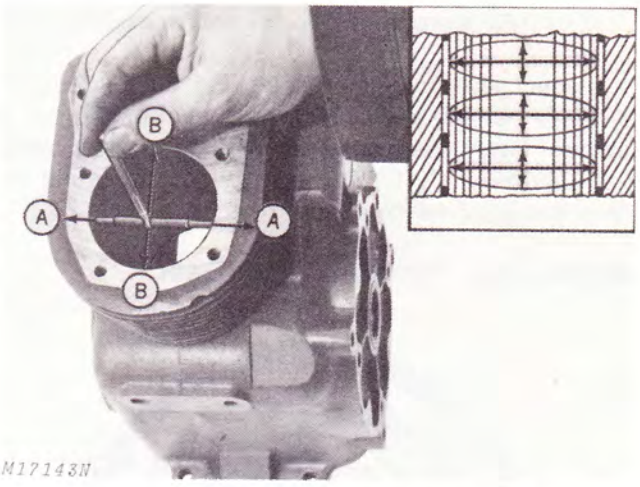
Note the crooked ball paths in the raceways, the oval appearance of the balls, and wear on the separator caused by rubbing against the race.

Inspecting and Repairing Block

After thoroughly cleaning the block, check it for cracks. Cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25 percent kerosene and 75 percent light engine oil.

Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If a crack is present, the coating will become discolored at the defective area. Replace the block if cracked.

NOTE: A short block is available for service.



A—Measuring Point **B—90° From Point "A"**

Fig. 68-Measuring Cylinder Bore

Use a telescoping gauge from the JDM-61 Telescoping Gauge Set to measure cylinder bore in six places: The top, center and bottom of ring travel, Fig. 68.

Refer to "Specifications," Group 20, for cylinder bore dimensions and wear tolerances.

Deglazing Cylinder Bore

A cylinder wall should always be deglazed prior to installing a new set of rings.

Deglazing is not intended to remove any appreciable amount of metal from the bore. It is intended to clean up and provide the proper surface. A proper bore surface feels smooth, but has a cross-hatch pattern of microscratches which can be seen. This finish will allow the new rings to conform to the cylinder bore. It will also retain a small film of oil to provide lubrication for the ring surface and prevent scoring.

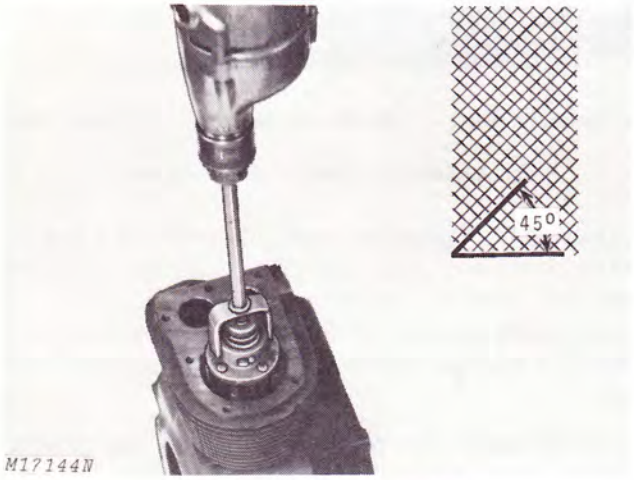


Fig. 69-Honing Cylinder Bore

Use a JDM-63-A Deglazing Tool to break glaze, Fig. 69.

A cross-hatch pattern (see inset) of approximately 45 degrees should be obtained by operating the tool vertically during deglazing.

Clean cylinder thoroughly with solvent. Any filings left on cylinder will cause rapid ring wear.

Boring Cylinder Block

If block is to be bored to accept 0.010 inch (0.254 mm), 0.020 inch (0.50 mm) or 0.030 inch (0.76 mm) oversize pistons, clean and dry block thoroughly.

Boring can be done by a reliable automotive repair shop, or by using an electric drill press and honing tool. See "Special Tools," Section 70. Follow instructions 1 thru 6 for reboring by honing.

IMPORTANT: If block is jigged in a drill press for honing, be sure honing tool and block are in true alignment.

1. Chuck hone in drill press with spindle speed of about 600 rpm.

2. Start with coarse stones and center cylinder under press spindle. Lower hone so lower end of stones contact lowest point in cylinder bore.

3. Rotate adjusting nut so that stones touch cylinder wall. Begin honing at bottom of cylinder. Move hone up and down at rate of 50 strokes-per-minute to avoid cutting ridges in cylinder wall. Every fourth or fifth stroke, move hone far enough to extend the stones one inch beyond top and bottom of cylinder bore.

4. Check bore every 30 or 40 strokes for size and straightness. If stones collect metal, clean with a wire brush each time hone is removed.

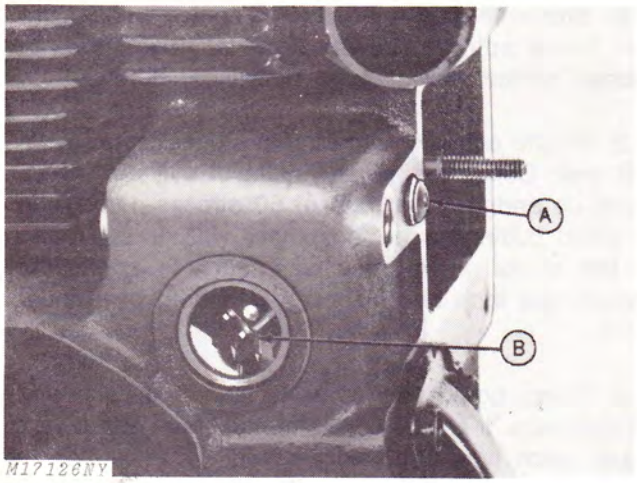
5. Hone with coarse stones, until cylinder bore is within 0.002 inch (0.0408 mm) of desired finish size. Replace coarse stones with finishing stones and continue until bore is to within 0.0005 inch (0.0127 mm) of desired size.

6. Clean cylinder with solvent and dry thoroughly.

Litho in U.S.A.

ASSEMBLY

Installing Governor

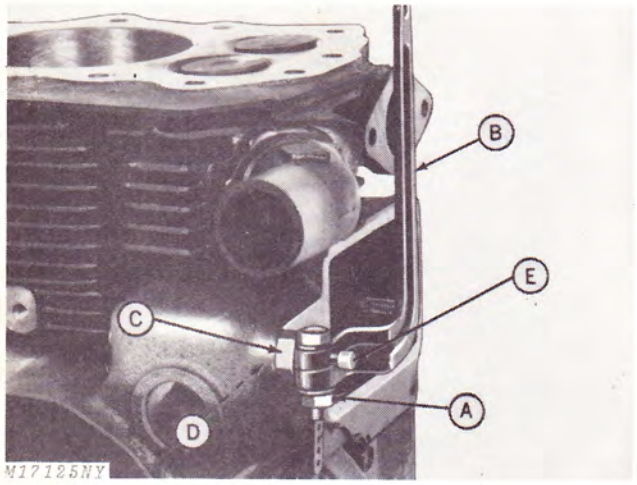


A—Stop Pin and Washer **B—Governor Assembly**

Fig. 70-Installing Governor Gear (Expansion Plug Removed for Visibility)

Install thrust washer (not illustrated) and governor assembly (B) on governor gear stub, Fig. 70.

Install stop pin and washer (A).



A—Nut
B—Governor Lever
C—Bushing
D—Spacer
E—Governor Shaft

Fig. 71-Installing Governor Shaft

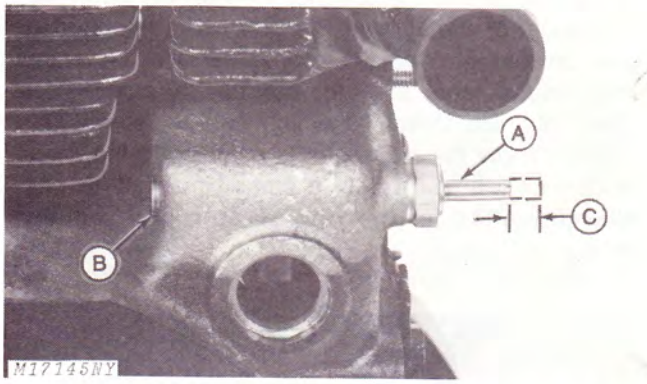
Install governor shaft (E) from inside cylinder block, Fig. 71.

Place spacer (D) over governor shaft (E).

Install bushing (C). Tighten bushing.

NOTE: Adjust governor shaft end play, Fig. 72, before installing governor lever (B).

Install governor lever (B) and tighten nut (A), Fig. 71.



A—Governor Shaft **B—Needle Bearing** **C—End Play**

Fig. 72-Adjusting Governor Shaft End Play

Grasp end of governor shaft (A) and move it in and out to check end play. End play (C) should be 1/64 inch (0.41 mm) to 1/32 inch (0.82 mm).

Tap needle bearing (B) into block to decrease end play. Tap against governor shaft (A) to increase end play.

IMPORTANT: To prevent damage, tap needle bearing at depressed center area only.

Installing PTO End Main Bearing

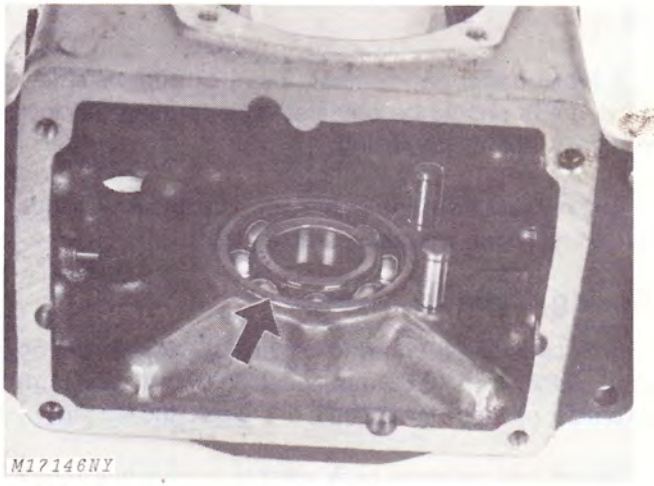
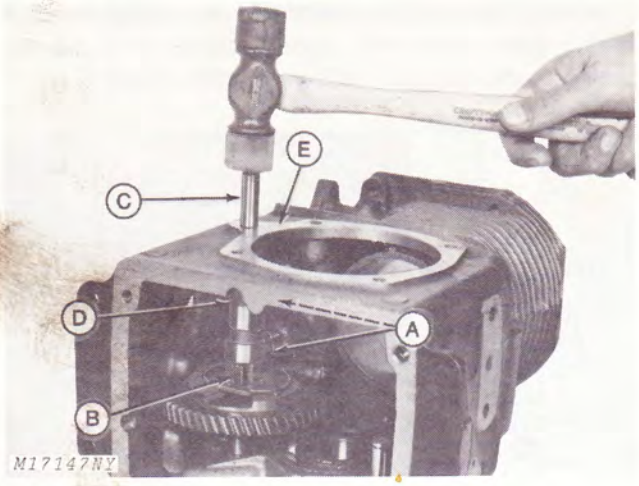


Fig. 73-Installing Main Bearing in Cylinder Block

Press main bearing, Fig. 73, from inside of cylinder block until it is bottomed out in bore.

Press on outer race of bearing and make sure bearing is not cocked in bore.

Installing Tappets and Camshaft



A—Tappets
B—Camshaft
C—Camshaft Pin
D—Spacer Washer
E—Bearing Plate Surface

Fig. 74-Installing Camshaft

Install tappets (A) in same guides from which they were removed, Fig. 74.

Hold camshaft (B) and spacer washer (D) in place and install camshaft pin (C) in place from flywheel side of block. Drive pin in until it is flush with bearing plate gasket surface (E).

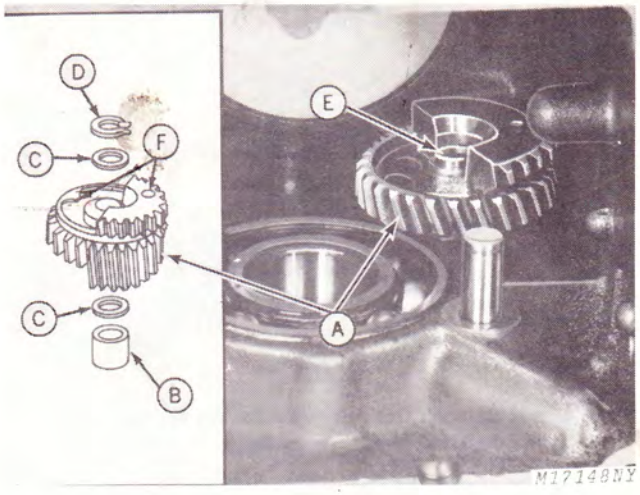
IMPORTANT: Drive camshaft pin into block from flywheel end only or cylinder block will be damaged.

To check camshaft end play, place a flat feeler gauge between camshaft and cylinder block. End play should be 0.005 inch (0.1270 mm) to 0.010 inch (0.254 mm). Adjust end play with more spacer washers (D).

Spin camshaft to make sure camshaft and governor turn freely.

Installing Balance Gears and Crankshaft Without Timing Tool on 300 Tractors (Serial No. 30,001 - 73,244)

JDST-3 Timing Tool, Fig. 81, is recommended for installing and timing balance gears. If timing tool is not available, install crankshaft and balance gears as follows:



A—Balance Gear
B—Thick Spacer
C—Thin Spacers
D—Retaining Ring
E—Stub Shaft
F—Timing Marks

Fig. 75-Installing K341AQS Engine Upper Balance Gear

IMPORTANT: Make sure timing marks (F) face up when balance gear is installed.

Install upper balance gear (A), Fig. 75, as follows:

Place thick spacer (B) over stub shaft (E).

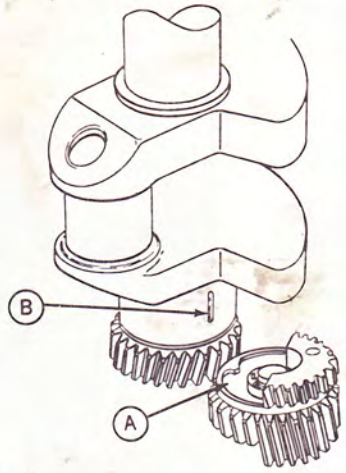
Install balance gear (A) on stub shaft with a thin spacer (C) on each side.

Install retaining ring (D).

Check balance gear end play with a flat feeler gauge. Adjust end play to 0.005 inch (0.127 mm) to 0.010 inch (0.254 mm) by adding or removing 0.005 inch (0.127 mm) spacers.

ASSEMBLY—Continued

Installing Balance Gears and Crankshaft Without Timing Tool on 300 Tractors (Serial No. 30,001-73,244)—Continued

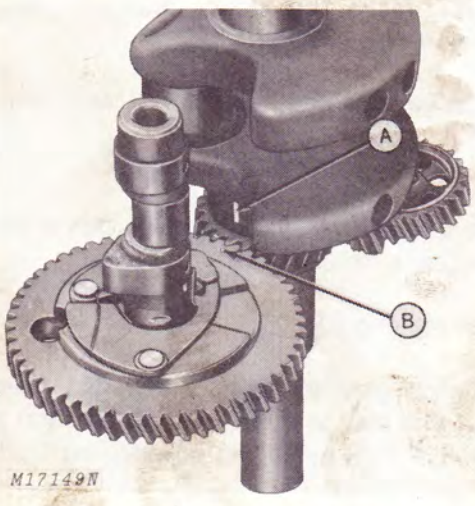


A—Upper Balance Gear Primary Timing Marks
B—Crankshaft Standard Timing Mark

Fig. 76-Aligning K341AQs Engine Upper Balance Gear

Lower crankshaft into cylinder block so that upper balance gear primary timing mark (A) aligns with crankshaft standard timing mark (B), Fig. 76.

Crankshaft should be engaged with upper balance gear but not with camshaft.



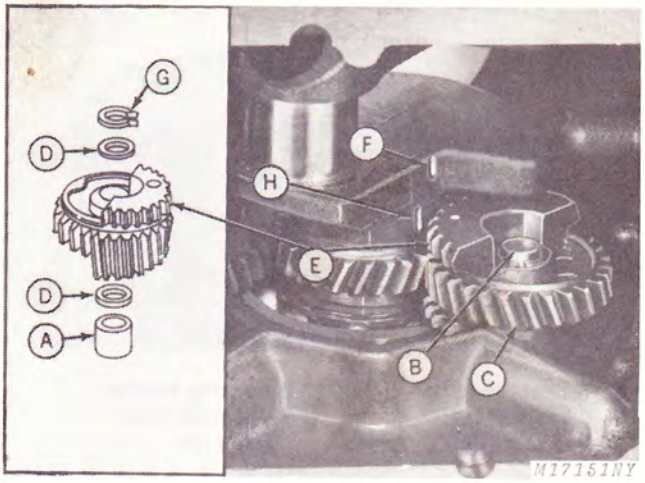
A—Crankshaft Standard Timing Mark
B—Camshaft Gear Timing Mark

Fig. 77-Aligning Camshaft Gear

Rotate crankshaft (and upper balance gear) until crankshaft standard timing mark (A) aligns with camshaft gear timing mark (B), Fig. 77.

Press crankshaft all the way into block.

Rotate crankshaft to check that crankshaft standard timing mark aligns with upper balance gear primary timing mark and camshaft gear timing mark.



A—Thick Spacer
B—Stub Shaft
C—Lower Balance Gear
D—Thinner Spacer
E—Lower Balance Gear Secondary Timing Mark
F—Crankshaft Secondary Timing Mark
G—Snap Ring
H—Crankshaft Standard Timing Mark

Fig. 78-Aligning K341AQS Engine Lower Balance Gear

Rotate crankshaft until lower balance gear can be installed without interference from crankshaft counterweights.

Install thick spacer (A) over stub shaft (B), Fig. 78.

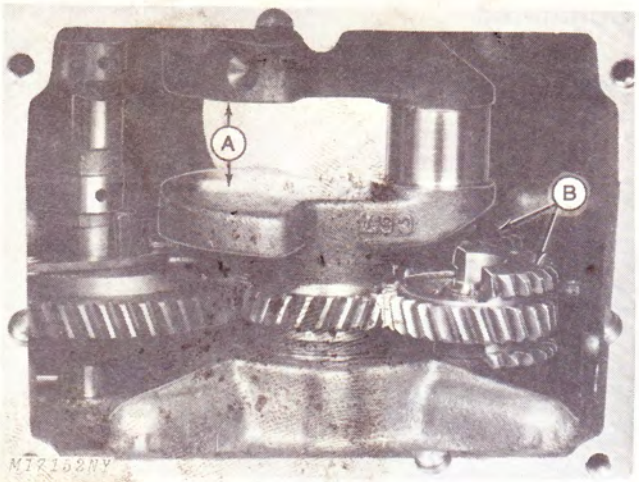
Install lower balance gear (C) with a thin spacer (D) on each side.

Install lower balance gear so that lower balance gear secondary timing mark (E) aligns with crankshaft secondary timing mark (F).

Install snap ring (G).

When lower balance gear slides into place and is fully engaged with crankshaft gear, the lower balance gear secondary timing mark (E) should then align with the crankshaft standard timing mark (H).

Check balance gear end play with a flat feeler gauge. Adjust end play to 0.005 inch (0.127 mm) to 0.010 inch (0.254 mm) by adding or removing 0.005 inch (0.127 mm) spacers.

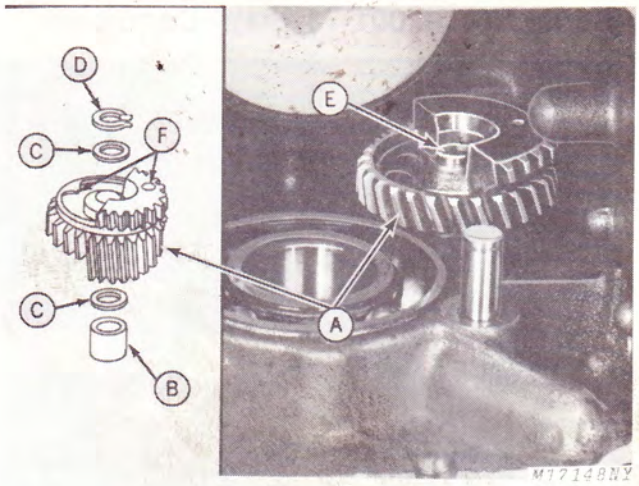


A—Crankshaft Counterweights
B—Wide Sections of Balance Gears

Fig. 79-Correctly Installed K341AQS Engine Balance Gears

Rotate crankshaft until crankshaft counterweights (A) are exactly as shown, Fig. 79. When properly installed, wide sections of balance gears (B) should form a straight line. If line is not straight, one of the balance gears was installed in the wrong crankshaft gear tooth. Review timing procedure to correct balance gear timing.

Installing Balance Gears and Crankshaft With Timing Tool on 300 Tractors (Serial No. 30,001-73,244)



A—Upper Balance Gear
B—Thick Spacer
C—Thin Spacers
D—Retaining Ring
E—Stub Shaft
F—Timing Marks

Fig. 80-Installing K341AQS Engine Balance Gears

IMPORTANT: Make sure timing marks (F) face up when balance gears are installed.

Install upper balance gear (A), Fig. 80, as follows:

Place thick spacer (B) over stub shaft (E).

Install upper balance gear (A) on stub shaft with a thin spacer (C) on each side.

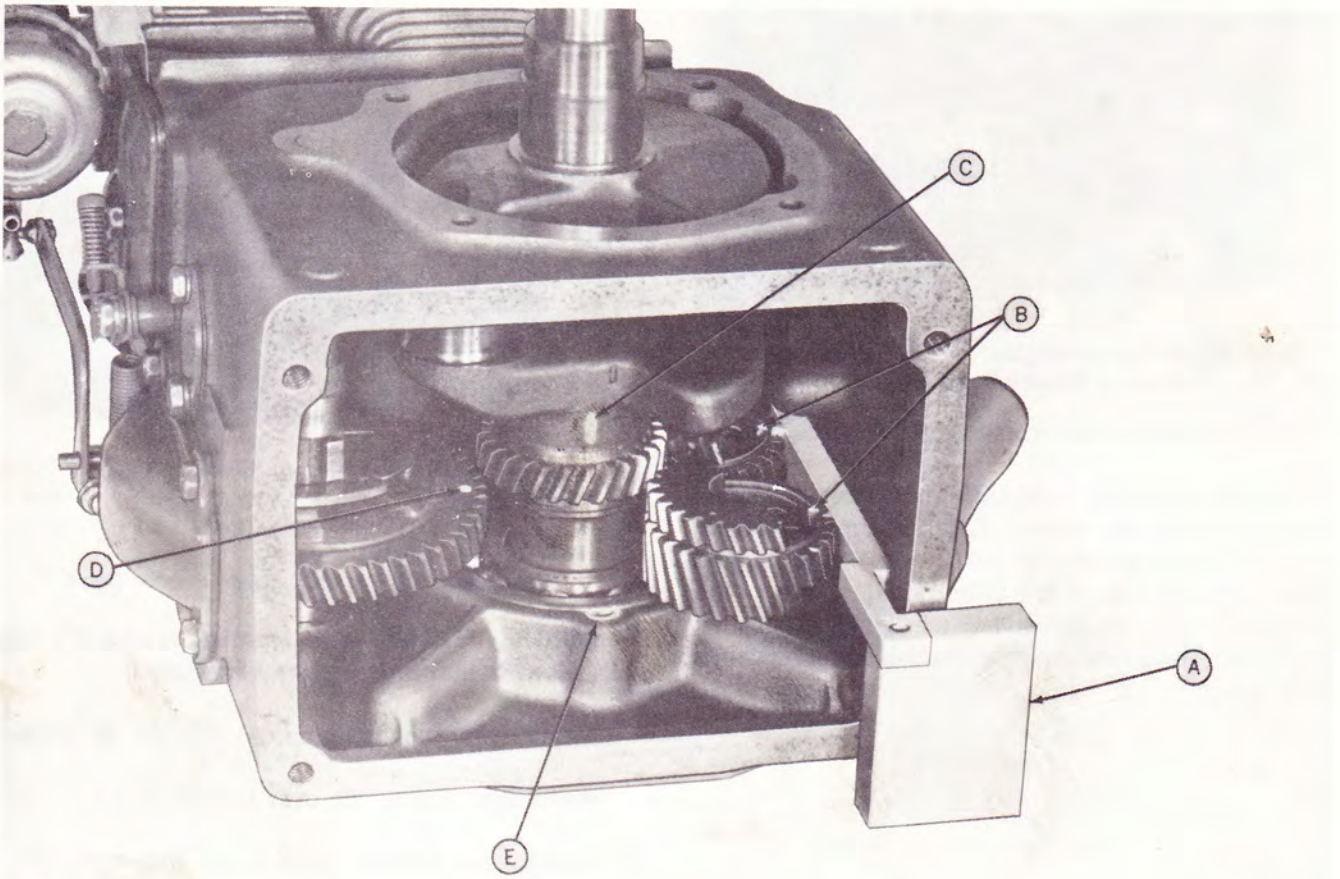
Install retaining ring (D).

Check balance gear end play with a flat feeler gauge. Adjust end play to 0.005 inch (0.127 mm) to 0.010 inch (0.254 mm) by adding or removing 0.005 inch (0.127 mm) spacers.

Repeat procedure for lower balance gear.

ASSEMBLY—Continued

Installing Balance Gears and Crankshaft With Timing Tool on 300 Tractors (Serial No. 30,001-73,244)—Continued



A—JDST-3 Timing Tool
B—Balance Gear Primary Timing Marks
C—Crankshaft Standard Timing Mark
D—Camshaft Gear Timing Mark
E—Lubrication Passage

Fig. 81-Timing K341AQS Engine Balance Gears with Timing Tool

Install JDST-3 Timing Tool (A) in cylinder block as shown, Fig. 81, so that balance gear primary timing marks (B) line up with teeth on timing tool.

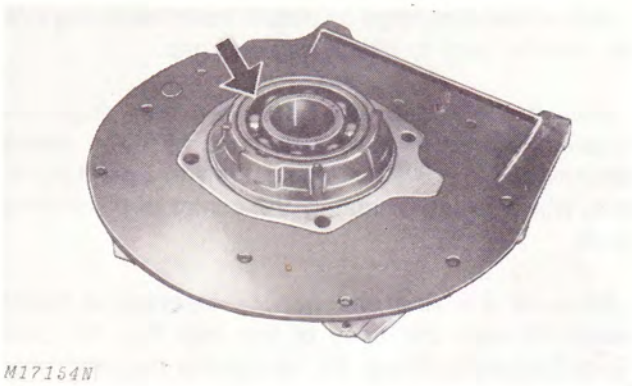
Install crankshaft so that crankshaft standard timing mark (C) aligns with lubrication passage (E). Lower crankshaft until approximately 1/16 inch (1.57 mm) of crankshaft gear engages wide side of balance gears.

Remove timing tool and rotate crankshaft until crankshaft standard timing mark (C) aligns with camshaft gear timing mark (D).

Tap crankshaft all the way into cylinder block with a soft-head mallet.

Gears are properly aligned when located as shown on page 20-15-29, Fig. 79.

Installing Flywheel End Main Bearing

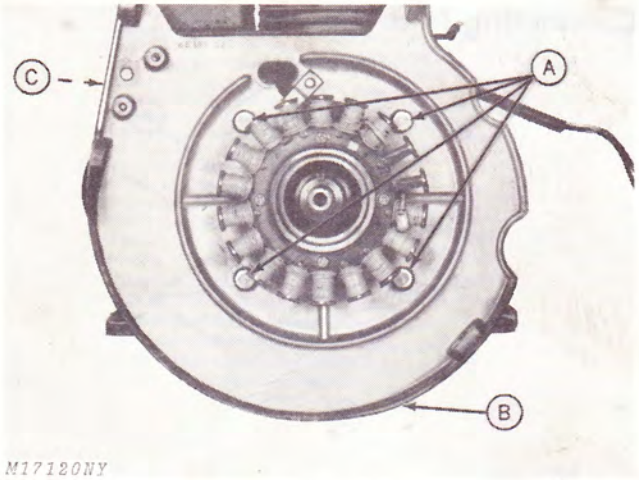


M17154N

Fig. 82-Installing Flywheel End Main Bearing

Press main bearing, Fig. 82, into bearing plate from inside until it bottoms out in bore. Press on outer race of bearing. Make sure bearing is not cocked in bore.

Installing Bearing Plate



M17120NY

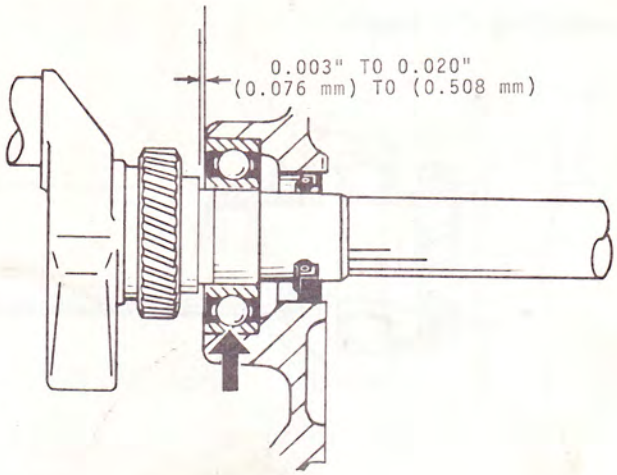
A—Cap Screws **B—Bearing Plate** **C—Gaskets**

Fig. 83-Installing Bearing Plate

Install one 0.020 inch (0.508 mm) and one 0.010 inch (0.254 mm) gaskets (C), Fig. 83.

Carefully tap bearing plate (B) over crankshaft until cap screws (A) can be started into block. Pull bearing plate (B) up to block by evenly tightening cap screws. Tighten cap screws.

Adjusting Crankshaft End Play



M17155N

Fig. 84-Adjusting Crankshaft End Play

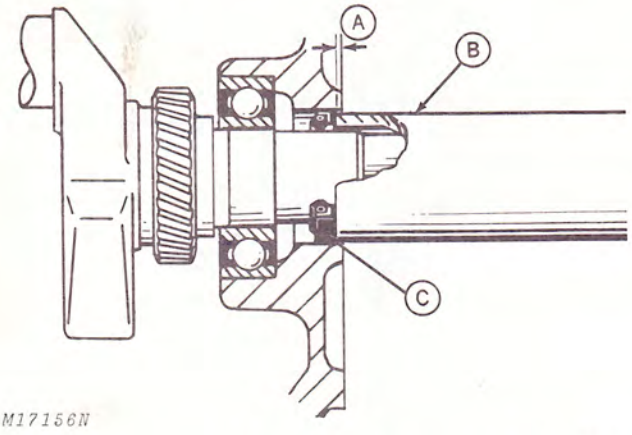
To seat the main bearings (arrow), tap the flywheel end of crankshaft with a soft-head mallet. Then tap the PTO end of crankshaft.

Check the distance between the PTO end main bearing inner race and the crankshaft shoulder, Fig. 84, with a flat feeler gauge.

Proper clearance is 0.003 inch (0.076 mm) to 0.020 inch (0.508 mm). To adjust clearance, add or remove 0.010 inch (0.254 mm) bearing plate gaskets, Fig. 83, as required.

ASSEMBLY—Continued

Installing Oil Seals



M17156N

A—Recess **B—Seal Tool** **C—Oil Seal**

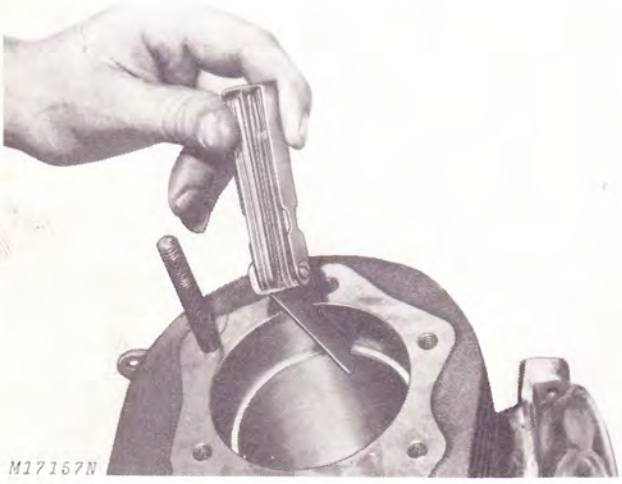
Fig. 85-Installing Oil Seals (PTO Seal Illustrated)

Lubricate oil seals before installing. Install oil seals with lips facing engine (numbers out). Use a seal tool to protect seal from being damaged.

Drive PTO oil seal into seal bore until outer face of seal is recessed 1/8 inch (3.18 mm), Fig. 85.

Drive flywheel oil seal into seal bore in bearing plate until outer face of seal is recessed 3/8 inch (9.53 mm).

Checking Piston Ring End Gap



M17157N

Fig. 86-Checking Piston Ring End Gap

Before installing rings on piston, insert each ring into the cylinder bore to check ring end gap.

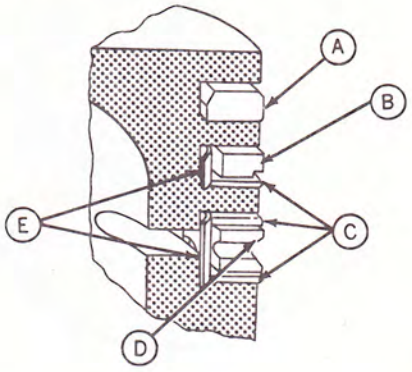
Always check ring end gap when new rings are installed. Use an inverted piston (top of piston down) without rings to push the ring squarely to a point in the bore, which is approximately the center of piston ring travel.

Measure the ring end gap by inserting a feeler gauge between the ends of the ring, Fig. 86. See "Specifications", Group 20, for correct ring end gap.

A minor increase in gap clearance can be made by filing the ends of the ring. This must be done accurately on equipment made for this purpose.

Too much end clearance indicates the wrong rings are being used or cylinder is worn too large.

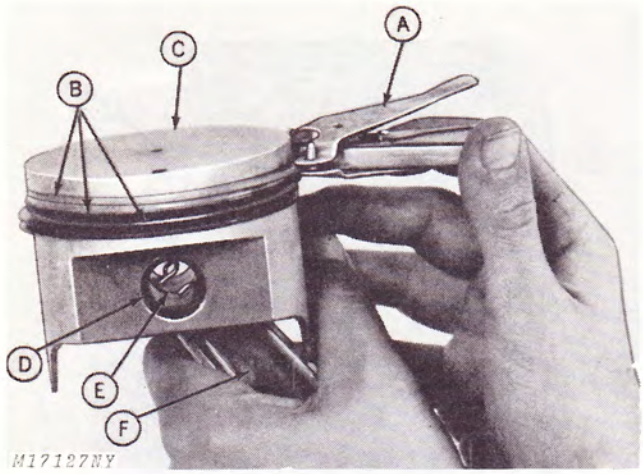
Installing Piston Rings and Connecting Rod



M17158N

A—Top Ring (Bevel Up)
B—Cast Iron Ring (Groove Down)
C—Chrome Steel Rails
D—Cast Iron Spacer
E—Expanders

Fig. 87-Piston Ring Installation



M17127NY

A—JDM-49 Ring Expander
B—Rings
C—Piston
D—Retaining Ring
E—Piston Pin
F—Connecting Rod

Fig. 88-Installing Rings on Piston

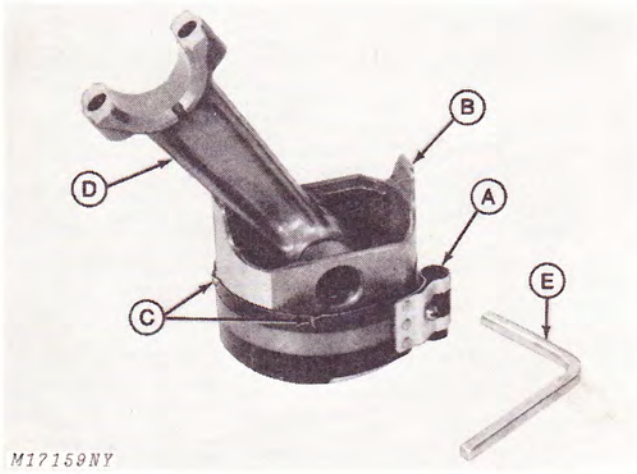
After checking ring end gap and side clearance, install rings (B) on piston (C), Fig. 88, with a JDM-49 Ring Expander, (A). Proper ring installation is shown in Fig. 87.

Coat piston pin (E) with a light film of oil. Insert pin through piston bore and connecting rod bearing. A properly fitted piston pin can be pressed into position with hand pressure.

Install retaining ring (D) in each end of piston pin bore. Make sure retaining rings are securely seated in retainer grooves.

Use a rod aligner to check rod and piston alignment. Follow manufacturer's recommendations for checking and correcting alignment.

Installing Ring Compressor



M17159NY

A—JDM-50 Ring Compressor
B—Piston
C—Projections
D—Connecting Rod
E—Wrench

Fig. 89-Installing Ring Compressor

Oil rings and piston skirt.

Place JDM-50 Ring Compressor (A) over piston (B), Fig. 89, with the projections (C) on the compressor toward the connecting rod (D).

Make sure compressor is flush with top of piston.

Tighten the compressor with wrench (E).

Installing Piston

M17160NY

Fig. 90-Installing Piston in Cylinder Block

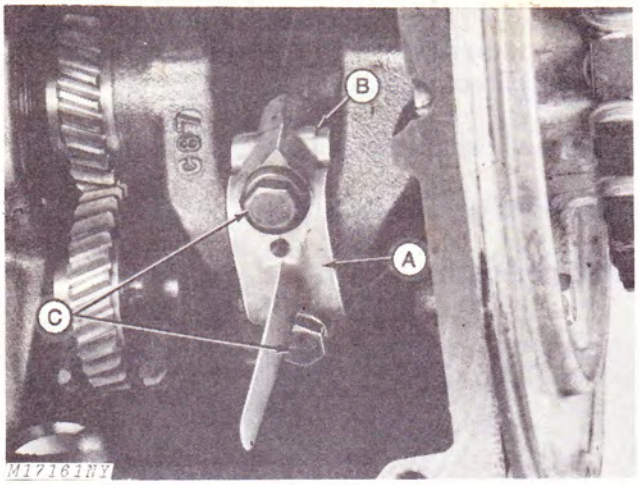
Coat connecting rod bearing surface with light oil.

IMPORTANT: Make sure match mark on connecting rod (see Fig. 91) faces flywheel side of engine.

Guide connecting rod through cylinder bore.

Guide connecting rod and piston into cylinder bore and push piston into cylinder bore with handle of a hammer, Fig. 90.

Installing Connecting Rod Cap



M17161NY

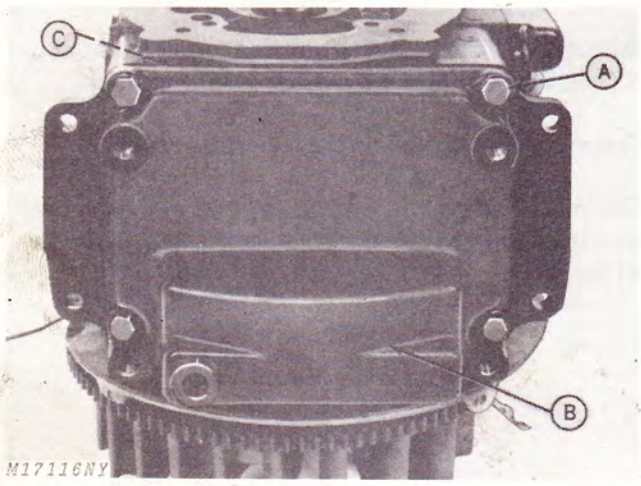
A—Connecting Rod Cap B—Match Marks
C—Cap Screw, Lock Washer and Flat Washer

Fig. 91-Installing Connecting Rod Cap K341AQS Engine Illustrated

Position connecting rod cap (A) around crankshaft journal as shown, Fig. 91. Make sure match marks (B) align.

Install cap screws and washers (C). Tighten cap screws to 25 ft-lbs (33.90 Nm) torque.

Installing Oil Pan



M17116NY

A—Cap Screw and Lock Washers B—Oil Pan C—Gasket

Fig. 92-Installing Oil Pan - K341AQS Engine Illustrated

Install new gasket (C) on oil pan (B).

Install oil pan (B) on cylinder block, Fig. 92.

Install cap screws and lock washers (A). Tighten cap screws.

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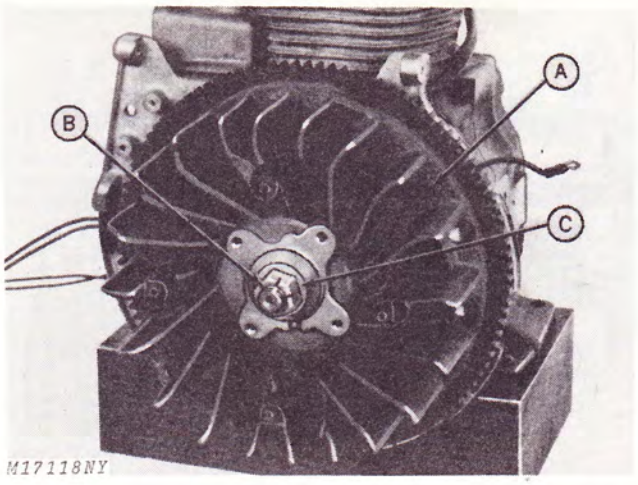
Installing Flywheel



M17118NY

A—Flywheel B—Flywheel Nut C—Washer

Fig. 93-Installing Flywheel

Place flywheel key in crankshaft keyway.

Install flywheel (A), washer (C) and flywheel nut (B) on end of crankshaft. Tighten nut.

Place a bar between flywheel fins, Fig. 93, and tighten flywheel nut to 60 to 70 ft-lbs (81.40 to 95.00 Nm) torque.

Installing Cylinder Head

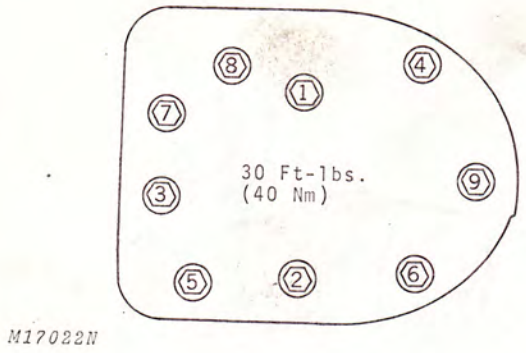


Fig. 4-Installing Cylinder Head on K301AS Engine on 312 Tractor

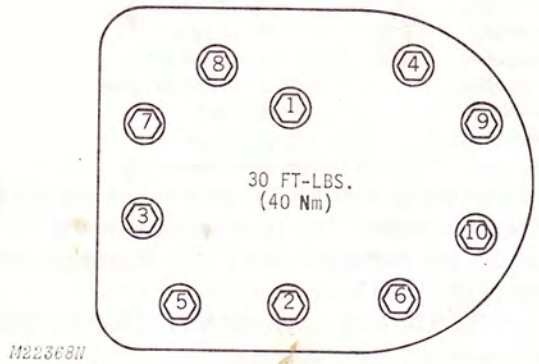


Fig. 95-Installing Cylinder Head on K341AQS Engine on 300, 314, and 316 Tractors

Always install a new gasket when cylinder head has been removed. This will ensure a gas-tight fit.

IMPORTANT: Install gasket dry. Do not use Permatex or other sealant.

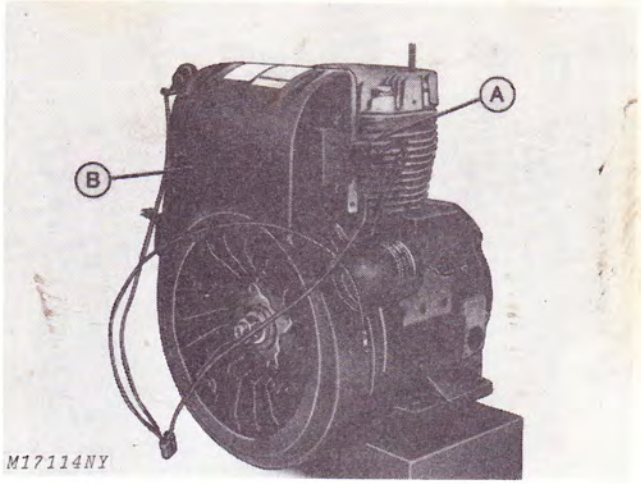
Install cylinder head gasket and cylinder head, Fig. 94 or 95 for respective engine.

Clean and apply a light film of oil to cylinder head bolts and nut to insure an accurate torque reading.

Tighten cylinder head bolts and nut in sequence shown, Fig. 94 or 95, to 100 in-lbs (11.52 Nm) torque. Continue tightening in sequence in 20 in-lb (3.62 Nm) steps until you reach torque.

IMPORTANT: After engine has been installed and run for a short time, let engine cool, then re-torque cylinder head bolts and nut.

Installing Blower Housing

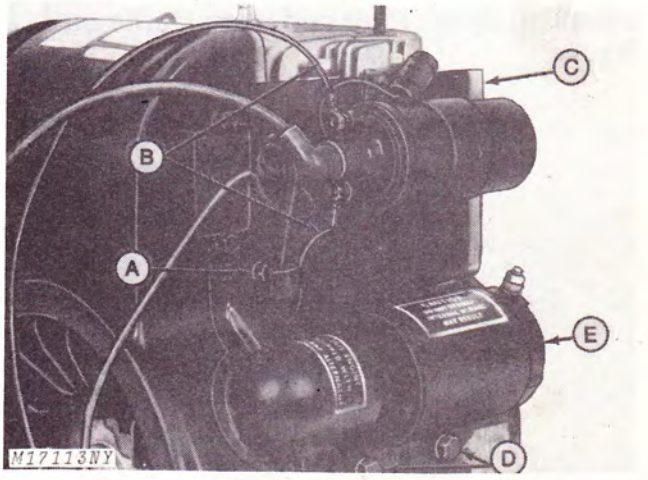


A—Wiring Harness **B—Blower Housing**

Fig. 96-Installing Blower Housing

Install blower housing (B), Fig. 96.
Connect wiring harness (A).

Installing Side Air Baffle and Starter

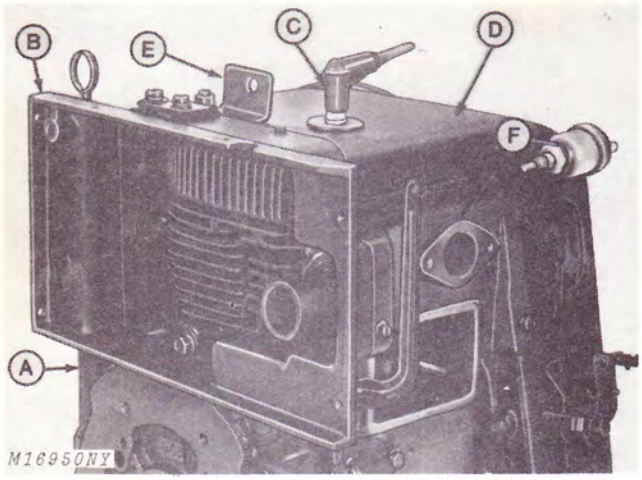


A—Cap Screw
B—Coil Leads
C—Side Air Baffle
D—Screws
E—Starter

Fig. 97-Installing Side Air Baffle and Starter

Install starter (E) and screws (D). Tighten screws.
Install side air baffle (C).
Install cap screw (A) with clip.
Connect coil leads (B).

Installing Air Duct and Baffles on 300, 314 and 316 Tractors



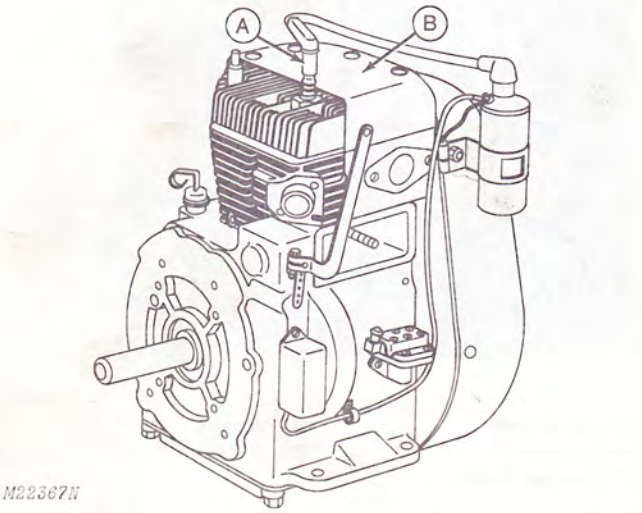
M16950NY

A—Oil Fill Tube **D—Head Baffle**
B—Air Duct **E—Lift Strap**
C—Spark Plug **F—Side Air Baffle**

Fig. 98-Installing Air Duct and Baffles

Install side air baffle (F), Fig. 98.
Install head baffle (D).
Install air duct (B).
Install oil fill tube (A) and gasket.
Install lift strap (E) and spark plug (C).

Installing Spark Plug and Head Baffle on 312 Tractor



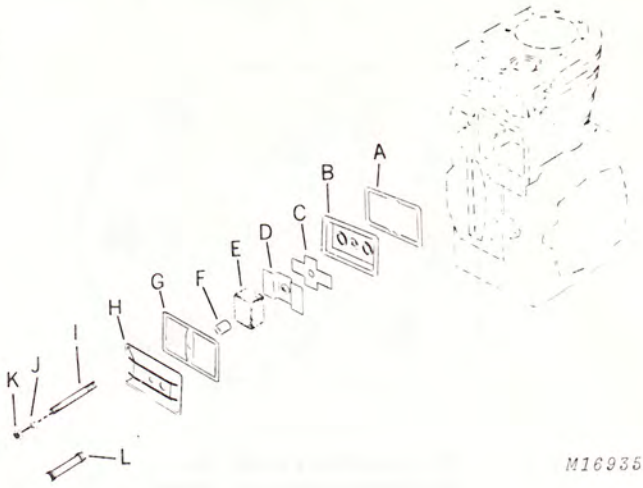
M22367N

A—Spark Plug **B—Head Baffle**

Fig. 99-Installing Spark Plug and Head Baffle

Install spark plug (A), Fig. 99.
Install head baffle (B).

Installing Breather



M16935

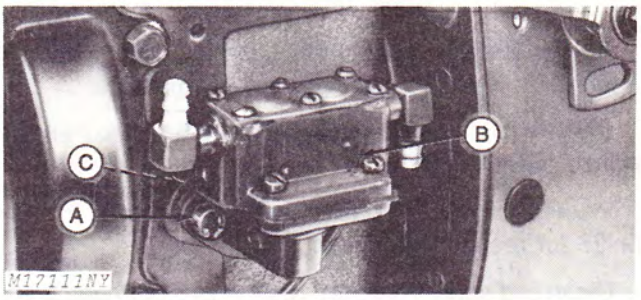
A—Gasket **G—Gasket**
B—Plate **H—Cover**
C—Reed **I —Stud**
D—Baffle **J —Lock Washer**
E—Filter **K—Nut**
F—Spacer **L —Hose**

Fig. 100-Breather Assembly

Install components of breather assembly, Fig. 100, exactly as shown. Use new gaskets (A and G) if old gaskets are damaged. Make sure small hole on bottom of plate (B) is down.

NOTE: 312 Tractors (Serial No. 70,001-80,000) are not equipped with hose (L).

Installing Fuel Pump



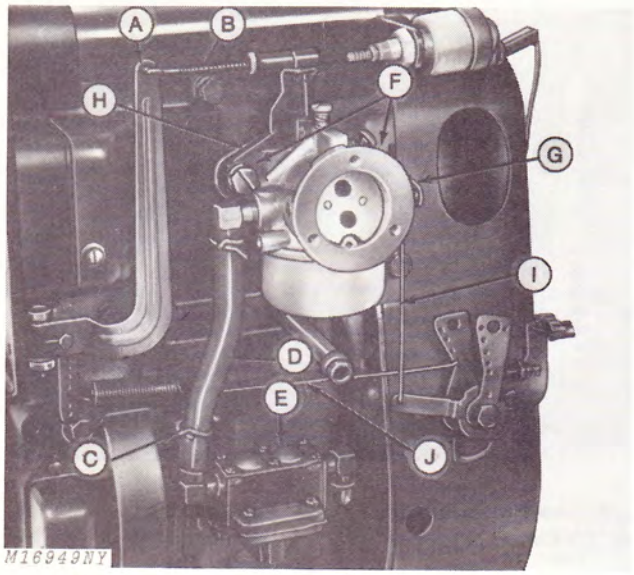
M17111NY

A—Screws **B—Fuel Pump** **C—Gasket**

Fig. 101-Installing Fuel Pump

Install gasket (C), fuel pump (B) and screws (A). Tighten screws.

Installing Carburetor



A—E-Ring
B—Governor Rod
C—Clamp
D—Fuel Line
E—Fuel Pump
F—Screws
G—Carburetor
H—Gasket
I —Choke Link
J —Governor Spring

Fig. 102-Installing Carburetor - K341AQS Engine Illustrated

Install gasket (H) and carburetor (G), Fig. 102.

Tighten carburetor mounting screws (F).

Connect fuel line (D) to fuel pump (E).

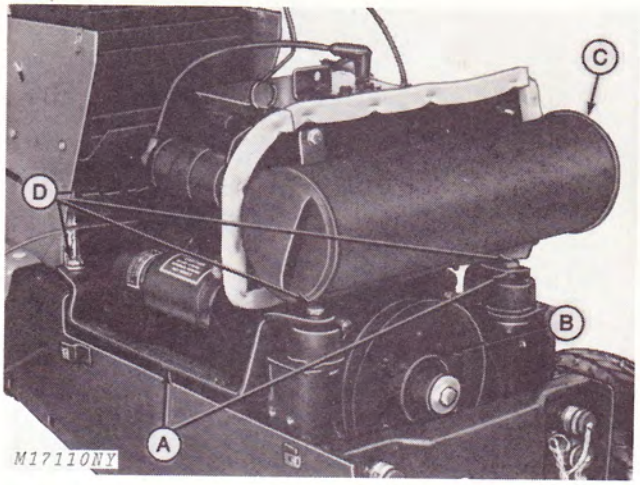
Install clamp (C) over fuel line.

Connect governor rod (B) and install E-ring (A).

Install choke link (I) and governor spring (J).

ENGINE INSTALLATION

Installing Engine



A—Engine Mounts
B—Electric PTO Clutch
C—Muffler
D—Cap Screws and Nuts

Fig. 103-Installing Engine - K341AQS Engine Illustrated

Install muffler (C) and engine mounts (A) on engine, Fig. 103.

Install electric PTO clutch (B), Section 40.

NOTE: See Fig. 104 or 105 and install drive shaft yoke (D) and intake screen (C).

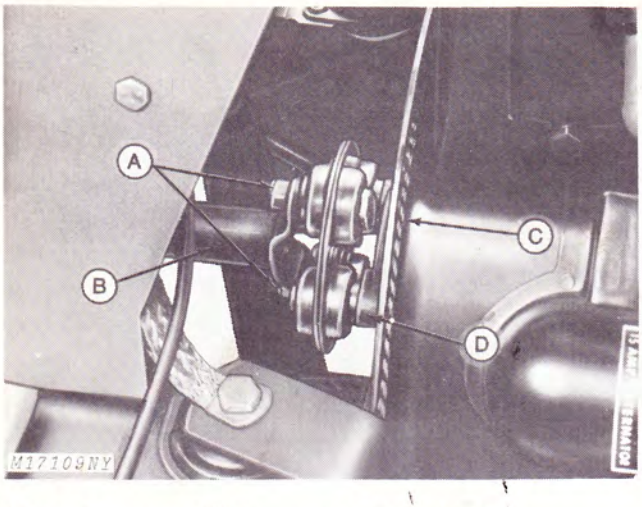
Lift engine into tractor frame with a hoist, Fig. 103.

Install four cap screws and nuts (D).

Tighten cap screws.

Installing Engine—Continued

300 Tractor (Serial No. 30,001-70,000)

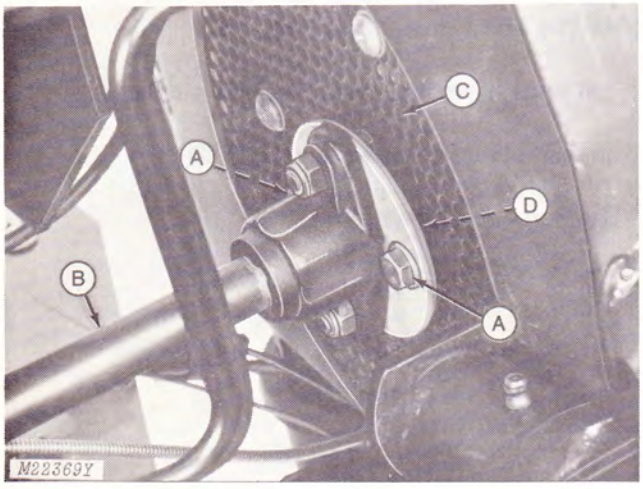


A—Cap Screws and Nuts
B—Drive Shaft
C—Intake Screen
D—Drive Shaft Yoke

Fig. 104-Connecting Drive Shaft Yoke on 300 Tractors Serial No. 30,001-70,000

Connect drive shaft (B) to drive shaft yoke (D) with two cap screws and nuts (A), Fig. 104. Tighten nuts.

300 Tractor (Serial No. 70,001-80,000) and 312 and 316 Tractors

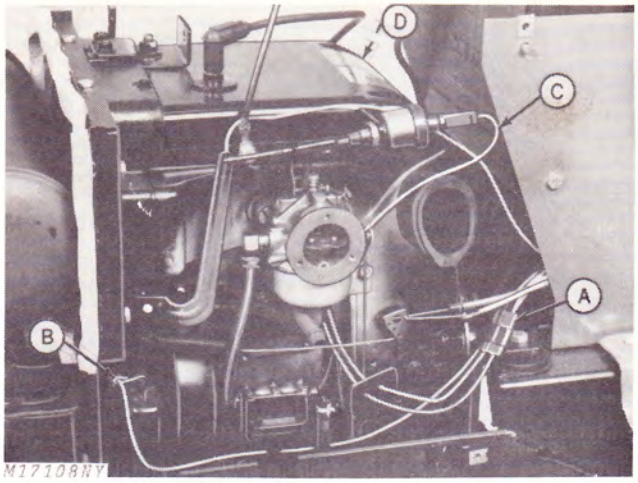


A—Cap Screws
B—Drive Shaft
C—Intake Screen
D—Drive Hub

Fig. 105-Connecting Drive Shaft on 300 Tractors (Serial No. 70,001-80,000) 312, 314 and 316 Tractors

Connect drive shaft (B) to drive hub (D) with two cap screws (A), Fig. 105. Tighten cap screws.

Connecting Wiring



A—Engine Wiring Harness
B—PTO Clutch Lead
C—Anti-Dieseling Solenoid Lead
D—Starter Cable

Fig. 106-Connecting Wiring - K341AQS Engine Illustrated

Install starter cable (D) on starter, Fig. 106.

On 300 and 316 Tractors connect anti-dieseling solenoid lead (C), electric PTO clutch lead (B) and engine wiring harness (A).

NOTE: 312 and 314 Tractors are not equipped with anti-dieseling solenoid lead (C).

Connect engine wiring harness (A) and electric PTO clutch lead (B) on 312 and 314 Tractors.

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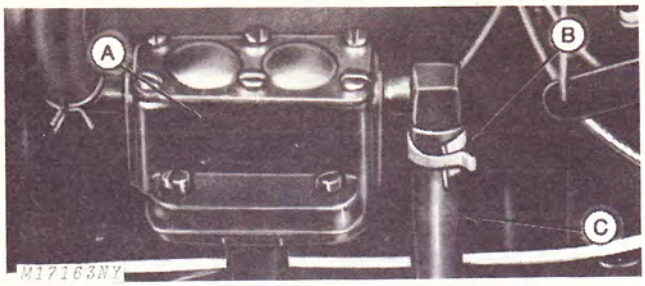
Installing Fuel Line

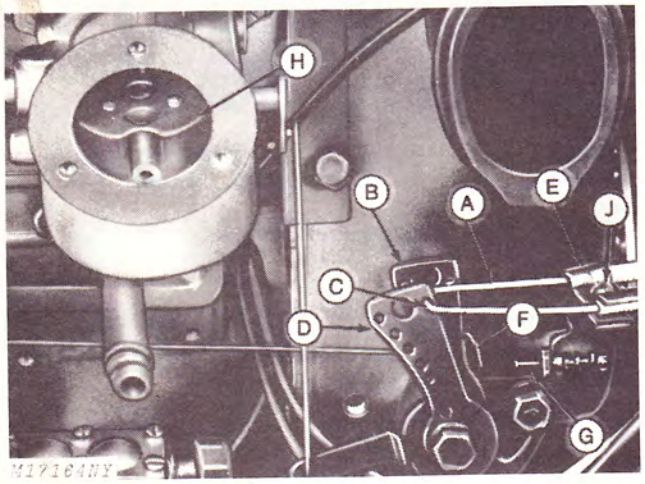


A—Fuel Pump **B—Clamp** **C—Fuel Line**

Fig. 107-Installing Fuel Line

Install fuel line (C) on fuel pump (A), and secure with clamp (B), Fig. 107.

Installing Throttle Cable and Choke Cable



A—Throttle Cable
B—Throttle Lever
C—Choke Cable
D—Choke Lever
E—Clamp
F—Throttle Lever Stop
G—Stop Screw
H—Choke Valve
J—Clamp Screw

Fig. 108-Installing Throttle Cable and Choke Cable - K341AQS Engine Illustrated

Place throttle lever on dash in "FAST" position.

Pull choke knob on dash all the way out.

Connect throttle cable (A) to throttle lever (B), Fig. 108.

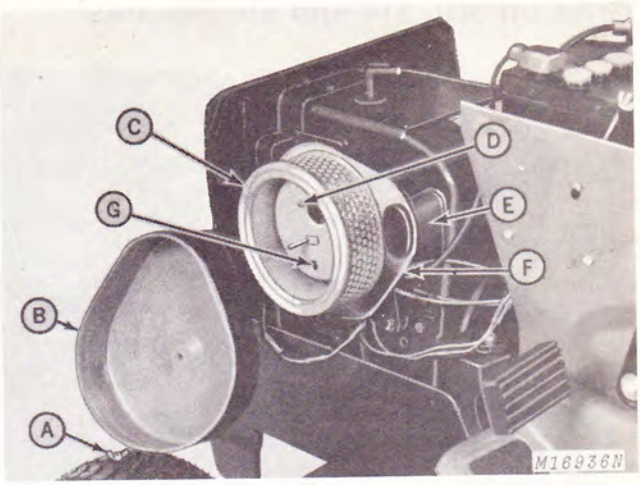
Connect choke cable (C) to choke lever (D).

Position throttle cable (A) in clamp (E) so that the throttle lever stop (F) rests against stop screw (G).

Position choke cable (C) housing in clamp (E) so that the choke valve (H) is completely closed.

Tighten clamp screw (J).

Installing Air Cleaner



A—Wing Nut
B—Cover
C—Element
D—Cap Screw
E—Air Intake Tube
F—Base
G—Breather Hose

Fig. 109-Installing Air Cleaner 300 Tractor Illustrated

On 312 Tractors (Serial No. 80,001-) and all 300, 314 and 316 Tractors, install air intake tube (E) and base (F), Fig. 109. Install cap screws (D).

On 312 Tractors (Serial No. 70,001-80,000) install base (F) with cap screws (D).

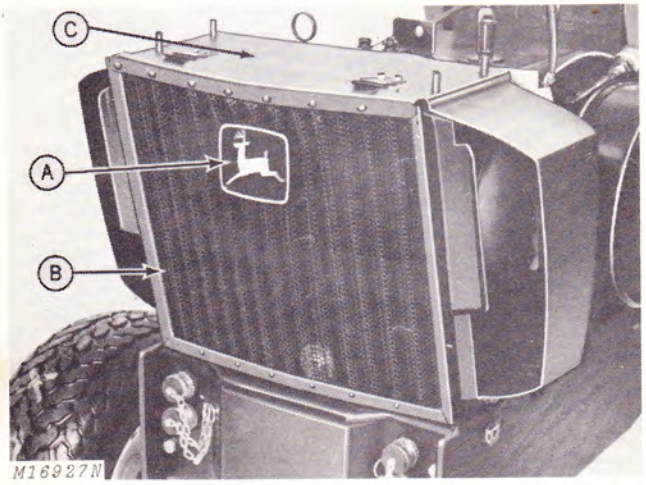
On 312 Tractors (Serial No. 80,001-) and all 300, 314 and 316 Tractors connect breather hose (G) to base (F).

Install element (C), cover (B) and wing nut (A). Tighten wing nut.

Make sure the seal around cover (B) is properly seated in base (F).

NOTE: Fill crankcase with oil and follow engine tune-up guide page 10-20-2 before installing hood and other parts.

Installing Hood, Side Panels and Grille on 300, 314 and 316 Tractors

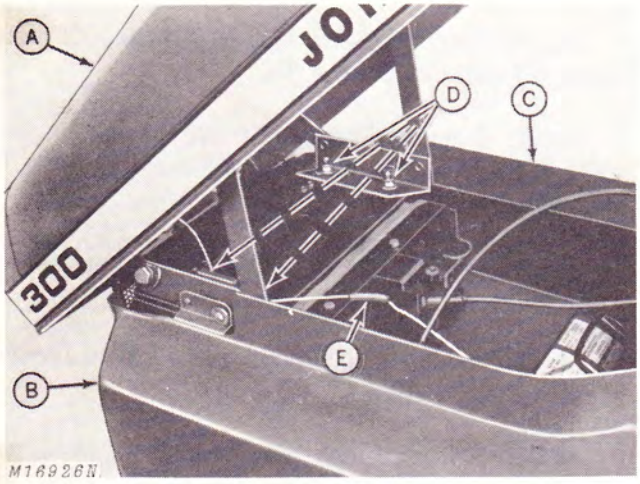


A—Grille Emblem **B—Grille** **C—Hood Support**

Fig. 110-Installing Hood Support and Grille

Install hood support (C), Fig. 110.

Grasp grille emblem (A) with your hand and install grille (B).



A—Hood
B—LH Side Panel
C—RH Side Panel
D—Nut
E—Headlight Harness

Fig. 111-Installing Hood and Side Panels

Install hood (A) and nuts (D), Fig. 111 on 300 and 316 Tractors. Install bolts on 314 Tractor.

Connect headlight harness (E).

Install right-hand side panel (C).

Install left-hand side panel (B).

Lower hood (A).

Install Hood Support, Hood, and Grille on 312 Tractors

A—Hood
B—Grille
C—Hood Support
D—Cap Screws

Fig. 112-Installing Hood Support, Hood and Grille

Bolt hood support (C), Fig. 112, with hood (A) to tractor frame with four cap screws (D) (two each side).

Install grille (B).

Litho in U.S.A.

Group 20
SPECIFICATIONS

300 AND 316 TRACTOR ENGINE

GENERAL SPECIFICATIONS

ENGINE MODEL NO.	HORSEPOWER	DISPLACEMENT	BORE	STROKE
K341AQS	16 hp (11.94 kW) @ 3500 rpm	35.89 cu. in. (588.237 cc)	3.750 in. (95.25 mm)	3.250 in. (82.55 mm)

TUNE-UP SPECIFICATIONS

Compression (1000 rpm)	110 to 120 psi (759 to 828 kPa)
Compression (ACR-400 rpm)	37 to 50 psi (255 to 345 kPa)
ACR Timing	32 to 40° BTDC
Spark Plug Gap	0.035 inch (0.889 mm)
Condenser Capacity	0.18 to 0.24 MFD
Breaker Point Gap	0.018 to 0.022 inch (0.457 to 0.559 mm)
Initial Carburetor Adjustment	High-Speed 1½ Turns-Idle ½ Turn
Idle rpm (Anti-Dieseling Solenoid)	2000 to 2200 rpm
Top Governed rpm	3400 to 3500 rpm
Intake Valve Clearance (Cold)	0.008 inch to 0.010 inch (0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 inch to 0.020 inch (0.432 to 0.508 mm)

INTERNAL SPECIFICATIONS

CYLINDER BLOCK		
Piston Bore Diameter (New)	3.750 inch (95.25 mm)	
Piston Bore Taper (Maximum)	0.005 inch (0.127 mm)	
Piston Bore Out-of-Round (Maximum)	0.005 inch (0.127 mm)	
CRANKSHAFT		
Main Bearing Diameter (Both Ends)	1.5745 to 1.575 inch	(39.99 to 40.00 mm)
Connecting Rod Journal Diameter	1.4995 to 1.5000 inch	(38.09 to 38.10 mm)
Connecting Rod-to-Journal Side Clearance	0.007 to 0.016 inch	(0.178 to 0.406 mm)
CAMSHAFT		
Camshaft Pin-to-Camshaft Clearance	0.001 to 0.0035 inch	(0.025 to 0.089 mm)
Camshaft Pin-to-Block (Bearing Plate End)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Camshaft Pin-to-Block (PTO End Interference Fit)	0.0015 to 0.003 inch	(0.038 to 0.076 mm)
Camshaft End Play	0.005 to 0.010 inch	(0.1270 to 0.2540 mm)
CONNECTING ROD		
Connecting Rod Bearing Diameter (Piston End)	0.8757 to 0.8760 inch	(2.224 to 2.225 cm)
Connecting Rod Bearing Diameter (Crankshaft End)	1.501 to 1.5025 inch	(3.813 to 3.816 cm)
Connecting Rod-to-Crankshaft Journal Running Clearance	0.001 to 0.002 inch	(0.025 to 0.051 mm)
Connecting Rod-to-Piston Pin Clearance	0.0003 to 0.0008 inch	(0.008 to 0.020 mm)

Litho in U.S.A.

300 AND 316 TRACTOR ENGINE

INTERNAL SPECIFICATIONS—Continued

CYLINDER HEAD		
Flatness (Maximum)	0.003 inch	(0.008 mm)
PISTON		
Piston Diameter (Bottom Skirt)	3.7450 to 3.7465 inch	(95.12 to 95.16 mm)
Piston Pin Diameter	0.8752 to 0.8754 inch	(2.223 to 2.224 mm)
Piston-to-Pin Clearance (Select fit-one thumb push)	0.000 to 0.003 inch	(0.000 to 0.076 mm)
Piston-to-Cylinder Bore (Thrust Face)	0.003 to 0.0045 inch	(0.076 to 0.114 mm)
Piston-to-Cylinder Bore (Top of Skirt)	0.007 to 0.0095 inch	(0.178 to 0.241 mm)
Top Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Middle Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Oil Ring Side Clearance	0.001 to 0.003 inch	(0.025 to 0.076 mm)
Ring End Gap	0.010 to 0.020 inch	(0.254 to 0.508 mm)
VALVES		
Intake Valve Clearance in Guide	0.001 to 0.004 inch	(0.025 to 0.102 mm)
Exhaust Valve Clearance in Guide	0.0025 to 0.004 inch	(0.064 to 0.102 mm)
Valve Guide in Block (Interference Fit)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Valve Seat in Block (Interference Fit)	0.003 to 0.005 inch	(0.076 to 0.127 mm)
Intake Valve Clearance (Cold)	0.008 to 0.010 inch	(0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 to 0.020 inch	(0.431 to 0.508 mm)
Valve Seat Angle	44.5°	
Valve Face Angle	45°	
Valve Seat Width	0.037 to 0.045	(0.940 to 1.143 mm)
Valve Tappet Clearance in Block	0.0008 inch	(0.020 mm)
Valve Guide Inside Diameter	0.312 to 0.313 inch	(7.925 to 7.950 mm)
Valve Guide Depth (Nominal)	1.469 inch	(37.31 mm)
Intake Valve Stem Diameter	0.3105 to 0.3110 inch	(7.886 to 7.899 mm)
Exhaust Valve Stem Diameter	0.3084 to 0.3091 inch	(7.833 to 7.851 mm)
Valve Face Width	0.031 inch	(0.787 mm)
Valve Spring Squareness	0.062 inch	(1.575 mm)
Intake Valve Spring Compressed	20 to 24 lbs @ 19/32 inch	(9.080 to 10.890 kg @ 1.509 cm)
Exhaust Valve Spring Compressed	20 to 24 lbs @ 19/32 inch	(9.080 to 10.890 kg @ 1.509 cm)
Intake Valve Spring Free Length	1.531 inch	(38.88 mm)
Exhaust Valve Spring Free Length	1.531 inch	(38.88 mm)
GOVERNOR		
Governor Bushing-to-Cross Shaft Clearance	0.001 to 0.0025 inch	(0.025 to 0.064 mm)
Governor Gear-to-Governor Shaft Clearance	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
MAIN BEARINGS		
Bearing-to-Cylinder Block Interference Fit	0.0006 to 0.0022 inch	(0.015 to 0.056 mm)
Bearing-to-Bearing Plate Interference Fit	0.0012 to 0.0028 inch	(0.030 to 0.071 mm)
Bearing-to-Crankshaft Interference to Loose Fit	0.0004 to 0.0005 inch	(0.010 to 0.013 mm)

TORQUE SPECIFICATIONS

Cylinder Head Bolts	25 to 30 ft-lbs	(33.90 to 40.80 Nm)
Spark Plug	27 ft-lbs	(36.60 Nm)
Connecting Rod Bolts	25 ft-lbs	(33.90 Nm)
Flywheel Nut	60 to 70 ft-lbs	(81.40 to 95.00 Nm)
Miscellaneous Hardware	Refer to "Torque Chart" page 10-10-3.	

Litho in U.S.A.

312 TRACTOR ENGINE

GENERAL SPECIFICATIONS

ENGINE MODEL NO.	HORSEPOWER	DISPLACEMENT	BORE	STROKE
K301AS	12 hp (8.94 kW) @ 3500 rpm	29.1 cu. in. (476.37 cc)	3.38 in. (85.80 mm)	3.250 in (82.55 mm)

TUNE-UP SPECIFICATIONS

Compression (1000 rpm)	110 to 120 psi (759 to 828 kPa)
Compression (ACR-400 rpm)	37 to 50 psi (255 to 345 kPa)
ACR Timing	32 to 40° BTDC
Spark Plug Gap	0.035 inch (0.889 mm)
Condenser Capacity	0.18 to 0.24 MFD
Breaker Point Gap	0.018 to 0.022 inch (0.457 to 0.559 mm)
Initial Carburetor Adjustment	High-Speed 2 Turns-Idle 2½ Turns
Idle rpm	2000 to 2200 rpm
Top Governed rpm	3400 to 3500 rpm
Intake Valve Clearance (Cold)	0.008 inch to 0.010 inch (0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 inch to 0.020 inch (0.432 to 0.508 mm)

INTERNAL SPECIFICATIONS

CYLINDER BLOCK		
Piston Bore Diameter (New)	3.38 inch (85.80 mm)	
Piston Bore Taper (Maximum)	0.005 inch (0.127 mm)	
Piston Bore Out-of-Round (Maximum)	0.005 inch (0.127 mm)	
CRANKSHAFT		
Main Bearing Diameter (Both Ends)	1.5745 to 1.575 inch	(39.99 to 40.00 mm)
Connecting Rod Journal Diameter	1.4995 to 1.5000 inch	(3.809 to 3.810 cm)
Connecting Rod-to-Journal Side Clearance	0.007 to 0.016 inch	(0.178 to 0.406 mm)
CAMSHAFT		
Camshaft Pin-to-Camshaft Clearance	0.001 to 0.0035 inch	(0.025 to 0.089 mm)
Camshaft Pin-to-Block (Bearing Plate End)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Camshaft Pin-to-Block (PTO End Interference Fit)	0.0015 to 0.003 inch	(0.038 to 0.076 mm)
Camshaft End Play	0.005 to 0.010 inch	(0.1270 to 0.2540 mm)
CONNECTING ROD		
Connecting Rod Bearing Diameter (Piston End)	0.8757 to 0.8760 inch	(22.24 to 22.25 mm)
Connecting Rod Bearing Diameter (Crankshaft End)	1.501 to 1.5025 inch	(3.813 to 3.816 cm)
Connecting Rod-to-Crankshaft Journal Running Clearance	0.001 to 0.002 inch	(0.025 to 0.051 mm)
Connecting Rod-to-Piston Pin Clearance	0.0003 to 0.0008 inch	(0.008 to 0.020 mm)
CYLINDER HEAD		
Flatness (Maximum)	0.003 inch	(0.008 mm)

Litho in U.S.A.

312 TRACTOR ENGINE

INTERNAL SPECIFICATIONS—Continued

PISTON		
Piston Diameter (Bottom Skirt)	3.3705 to 3.3715 inch	(85.61 to 85.63 mm)
Piston Pin Diameter	0.8752 to 0.8754 inch	(2.223 to 2.224 mm)
Piston-to-Pin Clearance (Select fit-one thumb push)	0.000 to 0.003 inch	(0.000 to 0.076 mm)
Piston-to-Cylinder Bore (Thrust Face)	0.003 to 0.0045 inch	(0.076 to 0.114 mm)
Piston-to-Cylinder Bore (Top of Skirt)	0.007 to 0.0095 inch	(0.178 to 0.241 mm)
Top Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Middle Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Oil Ring Side Clearance	0.001 to 0.003 inch	(0.025 to 0.076 mm)
Ring End Gap	0.010 to 0.020 inch	(0.254 to 0.508 mm)
VALVES		
Intake Valve Clearance in Guide	0.001 to 0.004 inch	(0.025 to 0.102 mm)
Exhaust Valve Clearance in Guide	0.0025 to 0.004 inch	(0.064 to 0.102 mm)
Valve Guide in Block (Interference Fit)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Valve Seat in Block (Interference Fit)	0.003 to 0.005 inch	(0.076 to 0.127 mm)
Intake Valve Clearance (Cold)	0.008 to 0.010 inch	(0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 to 0.020 inch	(0.431 to 0.508 mm)
Valve Seat Angle	44.5°	
Valve Face Angle	45°	
Valve Seat Width	0.037 to 0.045	(0.940 to 1.143 mm)
Valve Tappet Clearance in Block	0.0008 inch	(0.020 mm)
Valve Guide Inside Diameter	0.312 to 0.313 inch	(7.925 to 7.950 mm)
Valve Guide Depth (Nominal)	1.469 inch	(3.731 cm)
Intake Valve Stem Diameter	0.3105 to 0.3110 inch	(7.886 to 7.899 mm)
Exhaust Valve Stem Diameter	0.3084 to 0.3091 inch	(7.833 to 7.851 mm)
Valve Face Width	0.031 inch	(0.787 mm)
Valve Spring Squareness	0.062 inch	(1.575 mm)
Intake Valve Spring Compressed	20 to 24 lbs @ 19/32 inch	(9.080 to 10.890 kg @ 1.509 cm)
Exhaust Valve Spring Compressed	20 to 24 lbs @ 19/32 inch	(9.080 to 10.890 kg @ 1.509 cm)
Intake Valve Spring Free Length	1.531 inch	(38.88 mm)
Exhaust Valve Spring Free Length	1.531 inch	(38.88 mm)
GOVERNOR		
Governor Bushing-to-Cross Shaft Clearance	0.001 to 0.0025 inch	(0.025 to 0.064 mm)
Governor Gear-to-Governor Shaft Clearance	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
MAIN BEARINGS		
Bearing-to-Cylinder Block Interference Fit	0.0006 to 0.0022 inch	(0.015 to 0.056 mm)
Bearing-to-Bearing Plate Interference Fit	0.0012 to 0.0028 inch	(0.030 to 0.071 mm)
Bearing-to-Crankshaft Interference to Loose Fit	0.0004 to 0.0005 inch	(0.010 to 0.013 mm)

TORQUE SPECIFICATIONS

Cylinder Head Bolts	25 to 30 ft-lbs	(33.90 to 40.80 Nm)
Spark Plug	27 ft-lbs	(36.60 Nm)
Connecting Rod Bolts	25 ft-lbs	(33.90 Nm)
Flywheel Nut	60 to 70 ft-lbs	(81.40 to 95.00 Nm)
Miscellaneous Hardware	Refer to "Torque Chart" page 10-10-4.	

314 TRACTOR ENGINE

GENERAL SPECIFICATIONS

ENGINE MODEL NO.	HORSEPOWER	DISPLACEMENT	BORE	STROKE
K321AQS	14 hp (10.43 kW) @ 3500 rpm	31.3 cu. in. (513 cc)	3.50 in. (88.9 mm)	3.250 in. (82.5 mm)

TUNE-UP SPECIFICATIONS

Compression (1000 rpm)	110 to 120 psi (759 to 828 kPa)
Compression (ACR-400 rpm)	37 to 50 psi (255 to 345 kPa)
ACR Timing	32 to 40° BTDC
Spark Plug Gap	0.035 inch (0.889 mm)
Condenser Capacity	0.18 to 0.24 MFD
Breaker Point Gap	0.018 to 0.022 inch (0.457 to 0.559 mm)
Initial Carburetor Adjustment	High-Speed 2 Turns-Idle 2½ Turns
Idle rpm	2000 to 2200 rpm
Top Governed rpm	3400 to 3500 rpm
Intake Valve Clearance (Cold)	0.008 inch to 0.010 inch (0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 inch to 0.020 inch (0.432 to 0.508 mm)

INTERNAL SPECIFICATIONS

CYLINDER BLOCK		
Piston Bore Diameter (New)	3.50 inch (8.89 cm)	
Piston Bore Taper (Maximum)	0.005 inch (0.127 mm)	
Piston Bore Out-of-Round (Maximum)	0.005 inch (0.127 mm)	
CRANKSHAFT		
Main Bearing Diameter (Both Ends)	1.5745 to 1.575 inch	(39.99 to 40.00 mm)
Connecting Rod Journal Diameter	1.4995 to 1.5000 inch	(3.809 to 3.810 cm)
Connecting Rod-to-Journal Side Clearance	0.007 to 0.016 inch	(0.178 to 0.406 mm)
CAMSHAFT		
Camshaft Pin-to-Camshaft Clearance	0.001 to 0.0035 inch	(0.025 to 0.089 mm)
Camshaft Pin-to-Block (Bearing Plate End)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Camshaft Pin-to-Block (PTO End Interference Fit)	0.0015 to 0.003 inch	(0.038 to 0.076 mm)
Camshaft End Play	0.005 to 0.010 inch	(0.1270 to 0.2540 mm)
CONNECTING ROD		
Connecting Rod Bearing Diameter (Piston End)	0.8757 to 0.8760 inch	(22.24 to 22.25 mm)
Connecting Rod Bearing Diameter (Crankshaft End)	1.501 to 1.5025 inch	(37.813 to 37.816 mm)
Connecting Rod-to-Crankshaft Journal Running Clearance	0.001 to 0.002 inch	(0.025 to 0.051 mm)
Connecting Rod-to-Piston Pin Clearance	0.0003 to 0.0008 inch	(0.008 to 0.020 mm)
CYLINDER HEAD		
Flatness (Maximum)	0.003 inch	(0.008 mm)

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314 TRACTOR ENGINE

INTERNAL SPECIFICATIONS—Continued

PISTON		
Piston Diameter (Bottom Skirt)	3.4971 to 3.4985 inch	(88.82 to 88.86 mm)
Piston Pin Diameter	0.8752 to 0.8754 inch	(2.223 to 2.224 mm)
Piston-to-Pin Clearance (Select fit-one thumb push)	0.000 to 0.003 inch	(0.000 to 0.076 mm)
Piston-to-Cylinder Bore (Thrust Face)	0.003 to 0.0045 inch	(0.076 to 0.114 mm)
Piston-to-Cylinder Bore (Top of Skirt)	0.007 to 0.0095 inch	(0.178 to 0.241 mm)
Top Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Middle Ring Side Clearance	0.002 to 0.004 inch	(0.051 to 0.102 mm)
Oil Ring Side Clearance	0.001 to 0.003 inch	(0.025 to 0.076 mm)
Ring End Gap	0.010 to 0.020 inch	(0.254 to 0.508 mm)
VALVES		
Intake Valve Clearance in Guide	0.001 to 0.004 inch	(0.025 to 0.102 mm)
Exhaust Valve Clearance in Guide	0.0025 to 0.004 inch	(0.064 to 0.102 mm)
Valve Guide in Block (Interference Fit)	0.0005 to 0.002 inch	(0.013 to 0.051 mm)
Valve Seat in Block (Interference Fit)	0.003 to 0.005 inch	(0.076 to 0.127 mm)
Intake Valve Clearance (Cold)	0.008 to 0.010 inch	(0.203 to 0.254 mm)
Exhaust Valve Clearance (Cold)	0.017 to 0.020 inch	(0.431 to 0.508 mm)
Valve Seat Angle	44.5°	
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TORQUE SPECIFICATIONS

Cylinder Head Bolts	25 to 30 ft-lbs	(33.90 to 40.80 Nm)
Spark Plug	27 ft-lbs	(36.60 Nm)
Connecting Rod Bolts	25 ft-lbs	(33.90 Nm)
Flywheel Nut	60 to 70 ft-lbs	(81.40 to 95.00 Nm)
Miscellaneous Hardware	Refer to "Torque Chart" page 10-10-4.	

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Section 30
FUEL SYSTEM

Group 5
GENERAL INFORMATION

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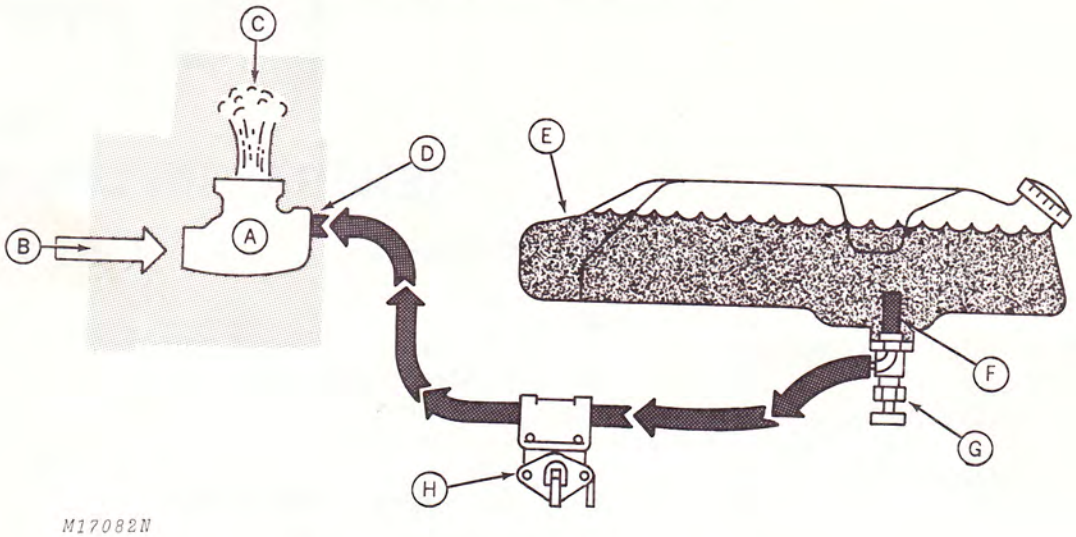
PRINCIPLE OF OPERATION



A—Carburetor
B—Air Intake
C—Fuel-Air Mixture
D—Fuel Intake
E—Fuel Tank
F—Strainer
G—Shut-Off Valve
H—Fuel Pump

Fig. 1-Fuel System

The fuel system, Fig. 1, consists of the fuel tank (E), strainer (F), shut-off valve (G), fuel pump (H) and carburetor (A).

The fuel pump (H) is operated by a cam on the engine camshaft and pumps fuel from the fuel tank (E) through the strainer (F) and shut-off valve (G) to the carburetor (A).

The side-draft, float-type carburetor (A) on 300 and 316 Tractors has three external adjustments: high-speed mixture needle, idle mixture needle and the anti-dieseling solenoid. 312 and 314 Tractors are not equipped with the anti-dieseling solenoid.

A replaceable dry-type air cleaner element is used to filter incoming air to the carburetor.

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DIAGNOSING MALFUNCTIONS

Hard Engine Starting

Engine flooded.

Restricted gas tank vent.

Fuel shut-off valve closed.

Restricted air filter element.

Choke control not properly adjusted.

High-speed and idle mixture needles not properly adjusted.

Fuel pump not pumping sufficiently.

Float valve leaking.

Dirty carburetor.

Water, rust or stale fuel in gas tank.

Engine Stalling

Restricted gas tank vent.

Choke control not properly adjusted.

Restricted air filter element

High-speed and idle mixture needles not properly adjusted.

Air lock in fuel line.

Restricted fuel line.

Fuel pump not pumping sufficiently.

Rough Idle

High-speed and idle mixture needles not properly adjusted.

Choke control not properly adjusted.

Restricted air filter element.

Damaged gasket between carburetor body and cylinder block.

Loose engine mounting bolts.

Incorrect carburetor float setting.

Carburetor float valve leaking.

Dirt, water or ice in fuel system.

Poor Acceleration

High-speed and idle mixture needles not properly adjusted.

Choke control not properly adjusted.

Restricted air filter element.

Governor adjusted incorrectly.

Dirty or damaged high-speed mixture needle.

Sticky fuel inlet needle.

Engine Surging

High-speed and idle mixture needles not properly adjusted.

Governor not properly adjusted.

Flooding or Leaking Carburetor

Sticky float valve.

Incorrect float setting.

Leaking float valve.

Gas Drips from Carburetor

Loose fuel fitting.

Fuel line loose on fuel fittings.

No Fuel Reaches Carburetor

Empty gas tank.

Restricted gas tank vent.

Fuel pump not pumping sufficiently.

Shut-off valve closed at fuel tank.

Fuel tank screen dirty.

Also see "Diagnosing Malfunctions" page 5-4 of Section 20—"ENGINES" for other solutions.

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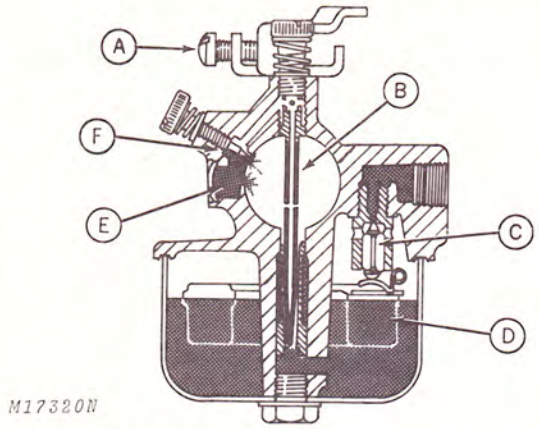
Group 10
CARBURETOR

GENERAL INFORMATION



A—Idle Stop Screw
B—High-Speed Mixture Needle
C—Float Valve
D—Float
E—Accelerating Well
F—Idle Mixture Needle

Fig. 1-Carburetor

Fuel enters the bowl through valve (C) controlled by the float (D), Fig. 1.

Air entering the carburetor is controlled by the choke valve when starting.

The air-fuel mixture entering the engine is regulated by the throttle valve which maintains uniform engine speed under varying loads, by increasing or decreasing air-fuel flow.

Whenever the throttle is opened quickly to give extra power for a sudden load, an extra amount of fuel is required for a momentarily richer air-fuel mixture.

The accelerating well (E), Fig. 1, provides the extra fuel.

The carburetor has two adjusting needles: One for high-speed (B), and one for low or idle speeds (F), Fig. 1, plus an idle stop screw (A).

The high-speed mixture needle (B), controls the amount of fuel entering the venturi at high engine speeds.

The idle mixture needle (F) controls the amount of fuel entering the venturi while the engine is idling or when the throttle valve is in the full-closed position.

REPAIR

Disassemble carburetor before placing it in cleaning solution to be sure the solution reaches all surfaces and parts.

Always install the complete repair kit when servicing the carburetor.

Always install new gaskets whenever the carburetor is disassembled.

Removal and Disassembly

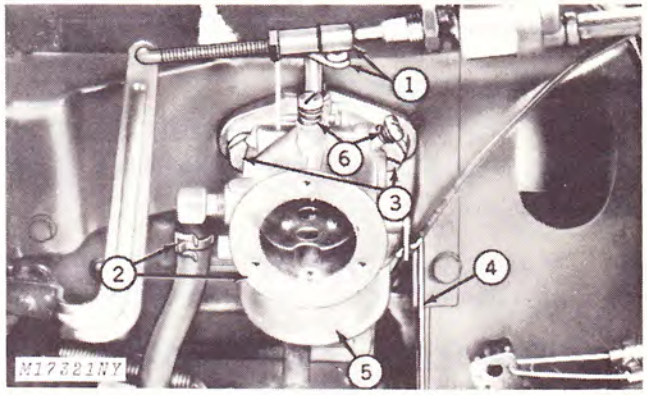


Fig.2-Removing Carburetor - 300 Tractor Illustrated

1. Remove governor throttle rod from carburetor throttle lever.
2. Remove air cleaner base and remove fuel line at carburetor.
3. Remove carburetor from engine block.
4. Disconnect choke control link.
5. Remove fuel bowl, float, float valve and seat.
6. Remove high-speed and idle mixture needles.

NOTE: Do not remove choke or throttle valves. If they are damaged, replace carburetor body.

Cleaning Carburetor

Clean all parts in a carburetor cleaning solvent.

IMPORTANT: Never clean holes or passages with small drill bits or wire, because an enlargement or burring of these holes will change the performance of the carburetor.

No method of cleaning other than solvent should be used.

Allow parts to remain in the solution from one to two hours. Then, remove and rinse all parts with clean solvent.

Dry parts with compressed air. Never use rags or paper to dry parts. Any lint may plug jets or channels affecting the operating efficiency of the carburetor.

IMPORTANT: Never use compressed air to clean a completely assembled carburetor. To do so may cause the float to collapse.

Inspecting Carburetor

Inspect float and float valve assembly, Fig. 3, for defects or wear. If either is noticed, replace parts as required.

Float valves and seats are available only as matched sets and should never be interchanged.

For a positive leak test, immerse the float in hot water. Any leak can be detected at once by air bubbles escaping from the float. Do not attempt to repair the float if it leaks. Replace it.

Check float pin and replace it if worn.

Check float dampener spring (T), if tractor is so equipped, and replace if weak or broken.

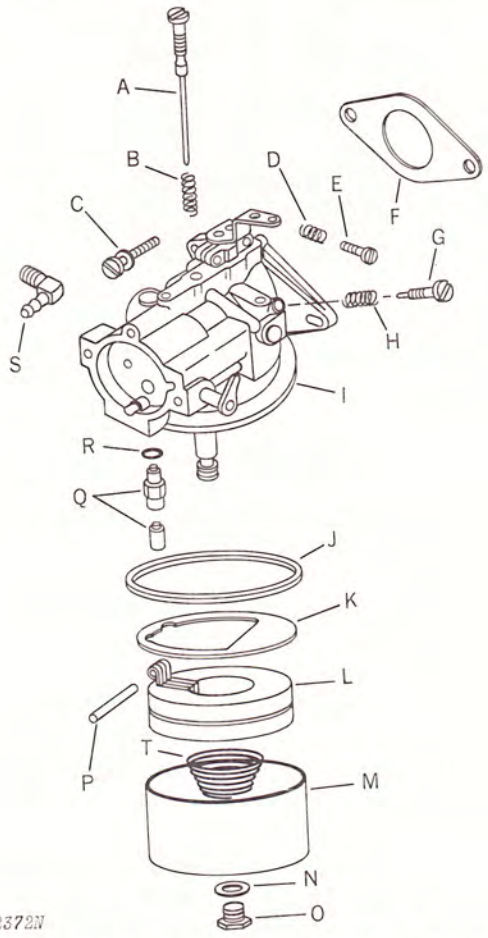
Inspect tapered ends of mixture needles (A and G), Fig. 3. Replace the needle if a ring has been cut in the tapered surface of either needle because the needle has been turned too tightly against the seat.

The seats for the high-speed and idle mixture adjusting needles are an integral part of the carburetor body casting and therefore cannot be removed or replaced.

Inspect carburetor body casting and fuel bowl for cracks or damaged sealing surfaces. Examine threaded holes for damaged threads.

Inspect jets for damaged or plugged holes. Replace jets if damaged.

Inspect throttle and choke valves for bends, cracks or other damage.



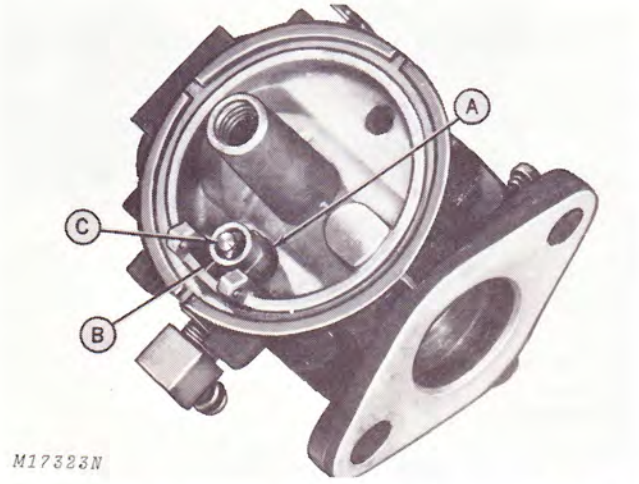
A—High-Speed Mixture Needle
B—Spring
C—Cap Screw
D—Spring
E—Idle Stop Screw
F—Gasket
G—Idle Mixture Needle
H—Spring
I —Carburetor Body with Choke and Throttle Valves
J —Bowl Ring Gasket
K—Bowl Gasket
L —Float
M—Bowl
N—Bowl Screw Gasket
O—Bowl Screw
P—Float Pin
Q—Float Valve Assembly
R—Gasket
S—Fuel Line Connector
T—Float Dampener Spring

Fig. 3-Exploded View of Carburetor Components

Assembly

Install the carburetor repair kit whenever the carburetor has been disassembled for service.

Installing Float Valve



A—Fiber Gasket **B—Valve Seat** **C—Valve**

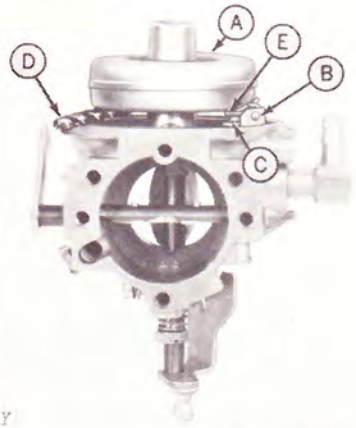
Fig. 4-Installing Valve Seat, Valve and Fiber Gasket

The valve seat (B), valve (C) and fiber gasket (A) are packaged together for service. Never replace one part without replacing the other parts.

Screw valve seat assembly (B), Fig. 4, into carburetor housing.

Insert valve (C) Fig. 4, with tapered end against valve seat.

Installing Float and Float Shaft



A—Float
B—Float Pin
C—Float Valve
D—11/64" (4.366 mm) Drill
E—Lip

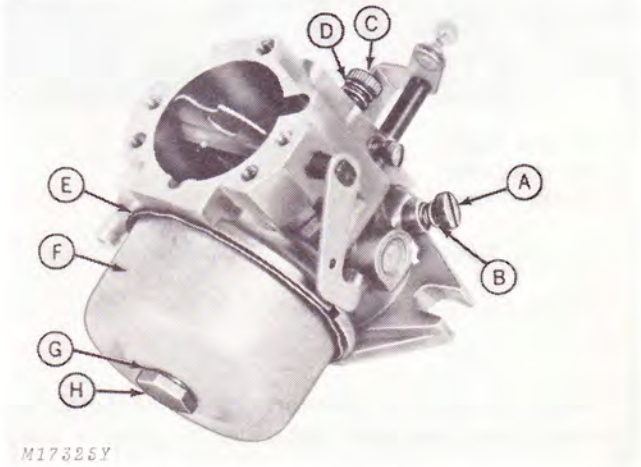
Fig. 5-Adjusting Float

Assemble float (A), Fig. 5, to carburetor housing with float pin (B). Invert carburetor, Fig. 5.

With float (A) resting lightly on float valve (C), the distance between float and machined surface of carburetor body should be 11/64 inch (4.366 mm) plus or minus 1/32 inch (0.794 mm). Use a 11/64 inch (4.366 mm) drill (D) to measure gap.

To increase or decrease gap, bend lip (E) on float (A), Fig. 5.

Dimension should be made on free end of float (opposite valve seat), Fig. 5.



A—Idle Mixture Needle
B—Spring
C—High-Speed Mixture Needle
D—Spring
E—Gasket
F—Bowl
G—Bowl Screw Gasket
H—Bowl Screw

Fig. 6-Installing Bowl and Preliminary Adjustments

Place float dampener spring (T), Fig. 3, page 30-10-2, inside bowl (F), Fig. 6.

Position bowl gasket (E), fuel bowl (F), bowl screw gasket (G) and bowl screw (H), Fig. 6. Tighten bowl screw firmly.

Install idle mixture needle (A) through spring (B) and high-speed mixture needle (C) through spring (D) Fig. 6. Install mixture needles into carburetor body as shown in Fig. 6. Carefully seat both needles finger-tight only.

IMPORTANT: Do not force needles too firmly against seat because it will groove needle point and cause carburetor malfunction.

Open high-speed mixture needle 1-1/2 turns and idle mixture needle 1/2 turn.

NOTE: These are preliminary adjustments only and will have to be reset with tractor in operation. See page 30-10-5 or 30-10-6 for adjustments.

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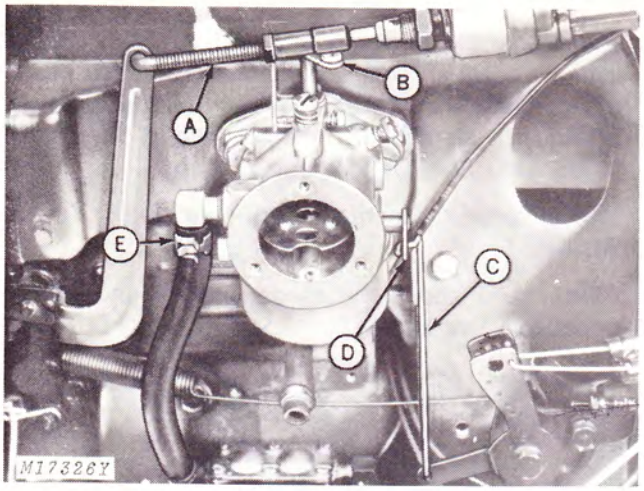
INSTALLATION



A—Throttle Rod
B—Throttle Lever
C—Choke Control Link
D—Lever Arm
E—Fuel Line

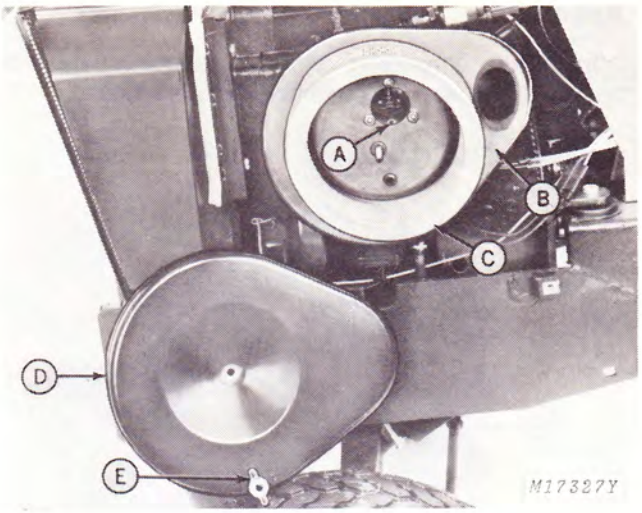
Fig. 7-Installing Carburetor - 300 Tractor Illustrated

Attach choke control link (C) to choke lever arm (D).

Place new gasket between carburetor flange and cylinder block and bolt carburetor to cylinder block, Fig. 7.

Attach throttle rod (A) to carburetor throttle lever (B), Fig. 7.

Attach fuel line (E) to carburetor.



A—Gasket
B—Base
C—Element
D—Cover
E—Wing Nut

Fig. 8-Installing Air Cleaner Base and Element - 300 Tractor Illustrated

Place new gasket (A) on carburetor body, Fig. 8, and attach air cleaner base (B) to carburetor.

Place filter element (C) on base making sure it seats tightly around base. Install cover (D) and tighten wing nut (E) finger-tight, Fig. 8.

ADJUSTMENTS

Adjusting Carburetor on 300 and 316 Tractors

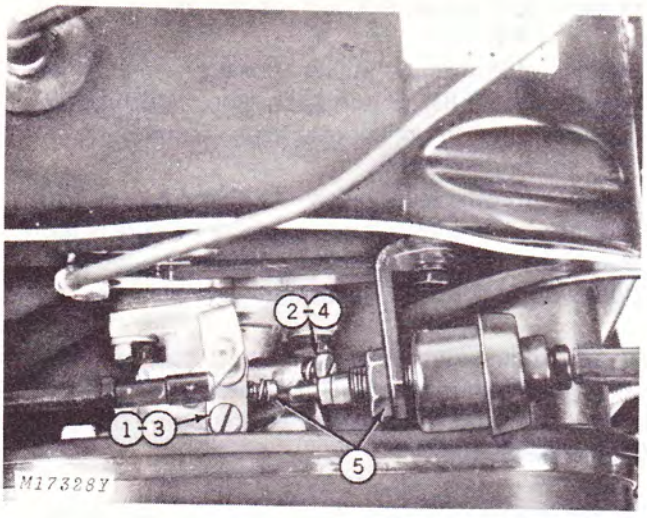


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Fig. 9-Adjusting Carburetor

1. Open choke (push knob on dash in). Turn highspeed mixture needle, Fig. 9, until closed fingertight. Then open 1½ turns.

2. Turn idle mixture needle, Fig. 9, until closed fingertight. Then open ½ turn.
   Start engine and raise throttle lever to "FAST" position. Allow engine to warm up.

3. With throttle lever in "FAST" position, turn highspeed mixture needle, Fig. 9, in ⅛-turn at a time until engine begins to miss (lean mixture). Then turn needle out until excess exhaust smoke is noticed (rich setting). Half-way between lean and over-rich, and slightly rich is the correct setting.

4. Move throttle lever to "SLOW" position. Adjust idle mixture needle, Fig. 9, for smooth idle and a slightly rich mixture.

   To check adjustments, advance throttle lever quickly. Check for uniform acceleration.

   If engine misses, gas-air mixture is too lean. Turn high-speed mixture needle out until positive acceleration is obtained.

   If excess smoke is observed, mixture is too rich. Re-adjust idle needle if necessary, until a good balance is achieved (engine accelerates and idles smoothly).

5. To set idle speed (with the engine running) move throttle lever to "SLOW" speed position. Loosen jam nut, Fig. 9, on the anti-dieseling solenoid. Rotate solenoid left or right until 2000 to 2200 rpm idle speed is attained. Tighten jam nut to lock solenoid in position.

NOTE: Make sure idle speed screw, Fig. 9, on carburetor is turned out until it no longer contacts the throttle bracket. This allows the throttle plate to close.

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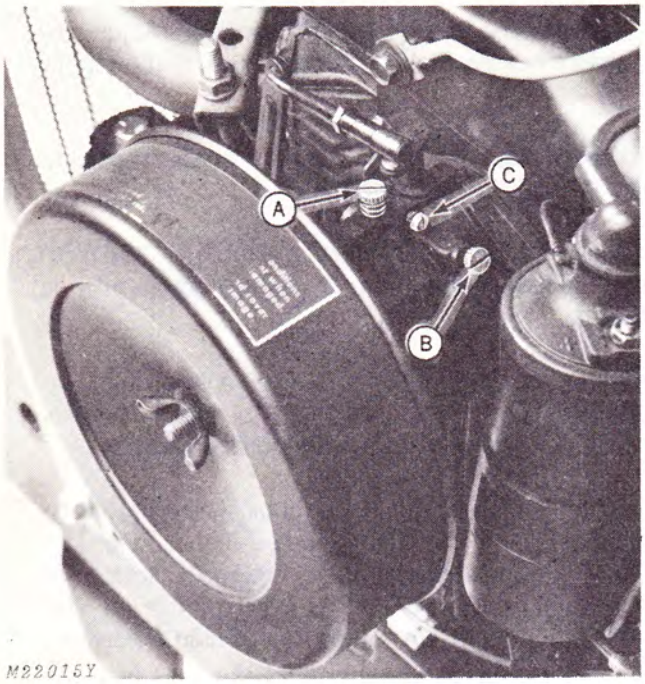
Adjusting Carburetor on 312 and 314 Tractor



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A—High-Speed Mixture Needle
B—Idle Mixture Needle
C—Idle Speed Screw

Fig.10-Adjusting Carburetor
312 Tractor Illustrated

NOTE: Idle adjustment and high-speed adjustment must be made at the same time as each affects the other. Adjust as follows:

1. Turn high-speed mixture needle (A) clockwise until closed. Close finger-tight only. Then open 2 turns.

2. Turn idle mixture needle (B) clockwise until closed. Close finger-tight only. Then open 2½ turns.

3. Start engine and raise throttle lever to "FAST" position. Allow engine to warm up.

4. Turn high-speed mixture needle (A) ⅛ turn each time, clockwise or counterclockwise, until engine runs smoothly at full throttle. Keep needle positioned slightly on the rich side (open) when operating with power-driven equipment such as the mower.

5. Move throttle lever to "SLOW" position and turn idle mixture needle (B) ⅛ turn each time, clockwise or counterclockwise until engine idles smoothly.

6. Advance throttle lever quickly to check for uniform acceleration. If engine misses, gas-air mixture is too lean. Turn high-speed mixture needle (A) counterclockwise until positive acceleration is attained.

If excess exhaust smoke is noticed, mixture is too rich. Readjust idle mixture needle (B), if necessary, until good balance is achieved and engine idles smoothly between 2000 and 2200 rpm.

7. To set idle speed (with the engine running) move throttle lever to "SLOW" speed position. Turn idle speed screw (C) until 2000 to 2200 rpm idle speed is attained on 314 Tractor or 2300 to 2500 rpm on 312 Tractor.

Adjusting Governor and Throttle Link

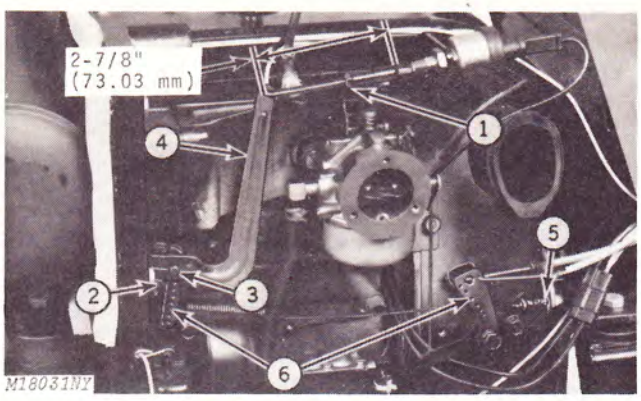

Fig. 11-Governor Adjustment - 300 Tractor Illustrated

1. Adjust the throttle link so it is 2-7/8 inch (73.03 mm) long measured from the center of the ball joint to the end of the throttle link.

Initial Governor Speed Adjustment

2. With the engine stopped, loosen hex. nut securing governor arm to cross shaft.

3. Grasp the end of the cross shaft with a pliers and turn it toward the front of the engine. The tab on the shaft will stop internally against the governor gear mechanism.

4. Hold the shaft in this position and pull the governor arm all the way from the carburetor; then, retighten the governor arm hex. nut.

The maximum speed for the 300, 312, 314 and 316 Tractor engine is 3500 rpm. This speed must not be exceeded. If an overspeed condition is suspected, check rpm with a vibration or electrical tachometer and adjust as follows.

Final Governor Speed Adjustment

5. Adjust the speed adjustment screw until a maximum speed of 3400 to 3500 rpm is attained. Tighten lock nut.

If engine speed drops considerably when a normal load is applied, set the governor for greater sensitivity. If set too sensitive, speed surging will occur with changing loads.

6. Adjust governor sensitivity by repositioning the governor spring in holes at the governor speed control brackets. Decrease governor sensitivity by moving spring into holes spaced further apart, increasing spring tension. Increase governor sensitivity by moving spring to holes spaced closer together, reducing spring tension.

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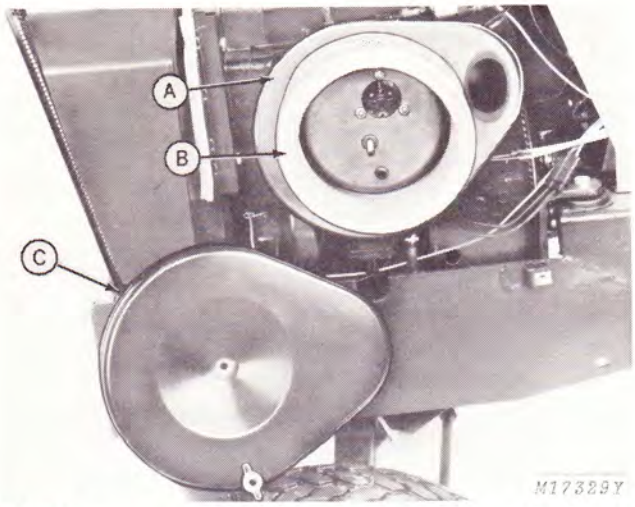
Group 15
AIR CLEANER

GENERAL INFORMATION



A—Base **B—Element** **C—Cover**

Fig. 1-Air Cleaner Assembly - 300 Tractor Illustrated

The air cleaner consists of a base (A) mounted to the carburetor, a filter element (B) and cover (C), Fig. 1.

The filter element is made of treated paper with a soft sealing edge.

Care of the air cleaner is important. All air entering the engine goes through the filter element.

A clogged filter restricts air flow and reduces engine efficiency.

A damaged filter may allow dirt to enter engine and cause damage to internal parts.

SERVICE

Cleaning

Clean air filter element every 25 hours of operation. Under extremely dusty conditions, clean filter element every 5 hours of operation.

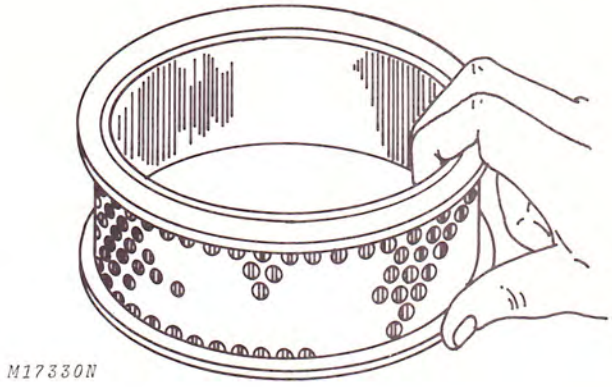


Fig. 2-Cleaning Air Filter Element

To clean air filter element, tap it against a flat surface and brush off dust.

⚠ CAUTION: Be careful not to damage the sealing edge on the filter element. This could cause leakage and result in damage to the engine.

Do not dip filter into a liquid cleaner of any type or blow dirt out with compressed air.

Replace filter if bent, crushed, damaged in any way or if extremely dirty. Under extremely dusty conditions, replace filter every 100 hours of operation.

When in doubt, replace filter. This is inexpensive insurance to protect the engine.

IMPORTANT: Never run engine with air filter element removed.

Wipe air cleaner base and inside of air cleaner cover with a clean cloth dampened with water.

Install air filter element making sure it seats around base.

Assemble cover and tighten wing nut on cover finger-tight.

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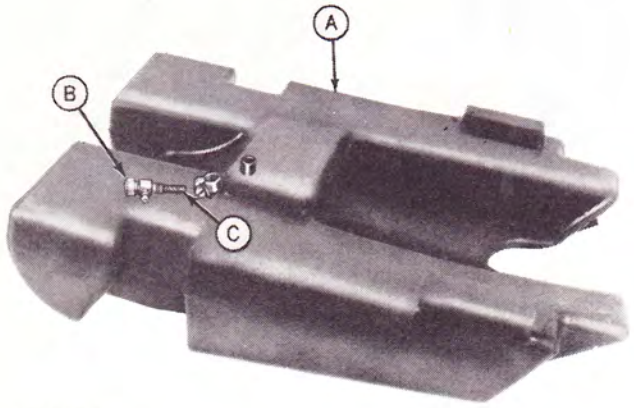
Group 20
FUEL TANK

GENERAL INFORMATION

Fuel Tank and Shut-Off Valve



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A—Fuel Tank **B—Shut-off Valve** **C—Screen**

Fig. 1-Fuel Tank and Shut-off Valve

The 4.5 gallon (17.03 l) fuel tank (A), Fig. 1, is located at the rear of the tractor under the fender-deck.

The tank is made of high-density polyethylene material.

The fuel tank (A) contains a shut-off valve (B) with a filtering screen (C) that maintains clean fuel to the engine.

Fuel Gauge (All 300 and 316 Tractors and 314 Tractors Serial No. 120,001 and Above)

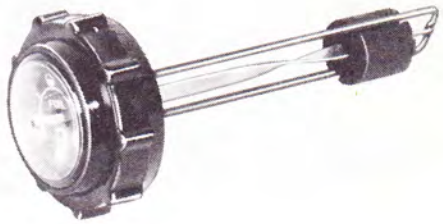

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Fig. 2-Fuel Gauge

The fuel gauge is located in the fuel tank cap. A float riding on a twisted shaft operates the gauge indicator.

NOTE: The fuel gauge is available as an accessory for 312 and early production 314 Tractors.

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REMOVAL

The fender-deck must be removed to gain access to the fuel tank. Follow the procedure below when removing the fender-deck.

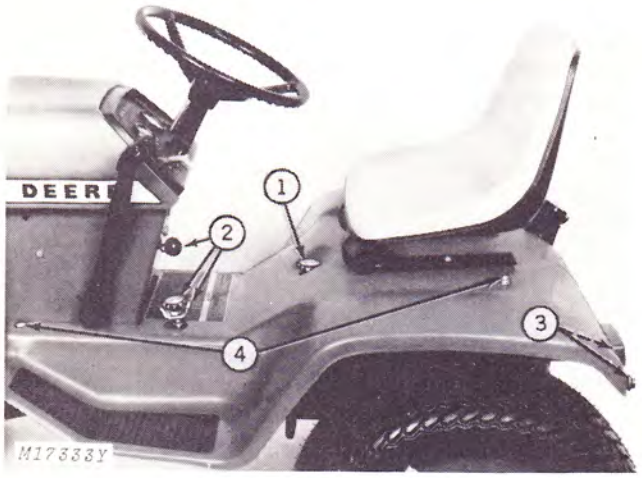


Fig. 3-Removing Fender-Deck

1. Remove the free-wheeling knob from the free-wheeling valve.

2. Remove the depth control knob, wing nut and the parking brake knob.

3. Remove the taillight bulbs and sockets by turning the socket 1/4 turn toward the right-hand side of the tractor.

4. Remove the four bolts from the fender-deck and lift the deck from the tractor.

After the fender-deck has been removed, the fuel tank can then be removed. Follow the procedure given below.

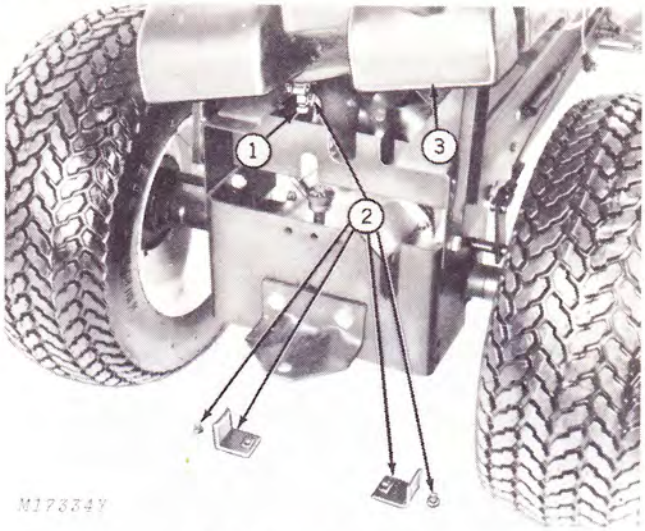


Fig. 4-Removing Fuel Tank - 300 Tractor Illustrated

1. Close the shut-off valve located at the bottom of the fuel tank.

2. On early production 300 Tractors only, remove the bolts and hold-down clamps from the fuel tank. Lift the tank far enough to remove the fuel line from the shut-off valve. Let fuel in the line drain into a container.

NOTE: Late model 300 Tractors and all 312, 314 and 316 Tractors are not equipped with tank hold-down clamps.

3. Lift the tank from the tractor.

Replace the tank in the reverse order of removal.

INSPECTION

Whenever the fuel tank is removed it should be inspected for leaks.

If the tank is damaged, replace it. Do not repair the fuel tank.

Remove the fuel shut-off valve and inspect it and the screen.

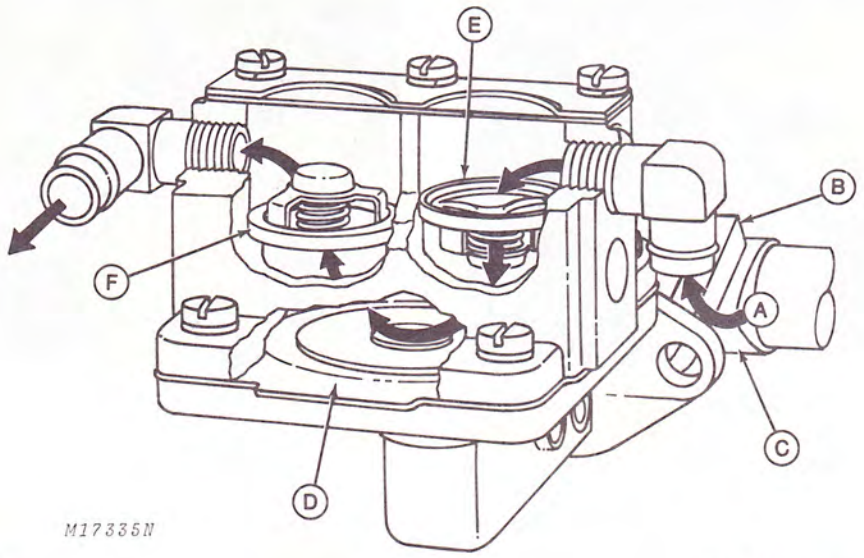
If the screen is clogged, clean it with solvent. Dry the screen with compressed air.

If the screen or shut-off valve is damaged, replace the assembly.

Litho in U.S.A.

Group 25
FUEL PUMP

PRINCIPLE OF OPERATION



A—Fuel
B—Lever
C—Camshaft Lobe
D—Diaphram
E—Inlet Check Valve
F—Outlet Check Valve

Fig. 1-Fuel Pump Operation

The fuel pump is a mechanically operated diaphram-type pump.

A lever (B), riding on a lobe of the engine camshaft (C) operates the diaphram (D) up and down, Fig. 1.

As the diaphram moves down, a low pressure area is created in the pump. This opens the inlet check valve (E) and closes the outlet check valve (F). Fuel (A) then enters the pump to fill the low pressure area.

As the diaphram is pushed up, the outlet check valve (F) opens, the inlet check valve (E) closes and fuel is pushed out of the pump to the carburetor.

A repair kit is available for reconditioning the pump. This kit includes the necessary gaskets, diaphram and check valves.

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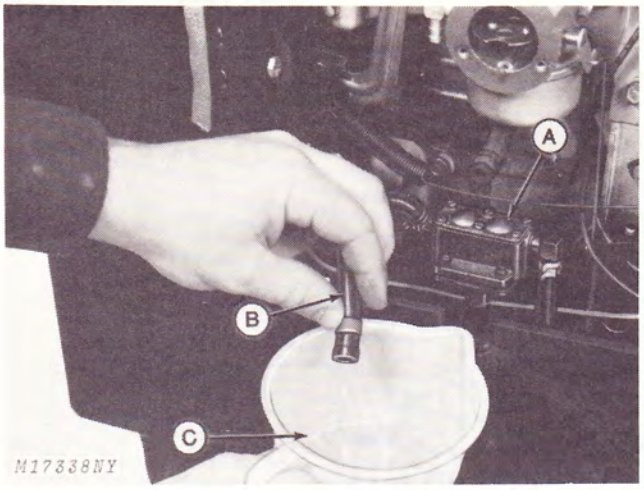
DIAGNOSIS AND TESTING



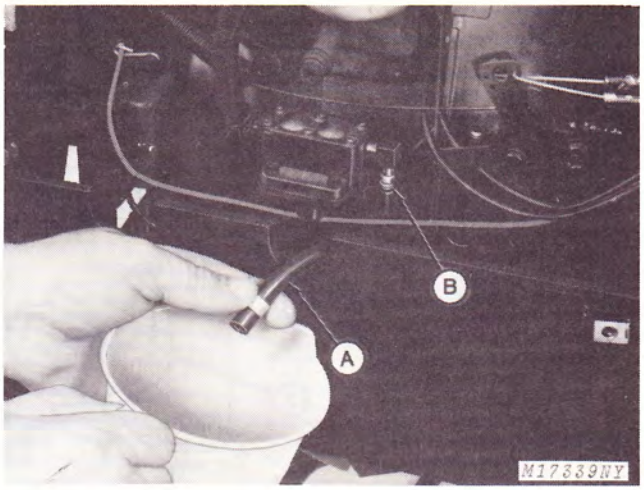
A—Fuel Pump B—Fuel Line C—Container

Fig. 2-Testing Pump Output

To test the fuel pump (A), remove fuel line (B), from the carburetor and place the end into a container (C), Fig. 2.

Remove the high-tension lead from the spark plug and ground it. Crank the engine several revolutions with the starter.

Observe fuel flow into the container. If no flow is observed, proceed to the next test.



A—Fuel Line B—Fuel Pump

Fig. 3-Testing Fuel Flow From the Fuel Tank

Disconnect the fuel line (A) from the inlet side of the fuel pump (B). Place the end of the fuel line (A) into a container, which is at a lower level than the fuel tank, Fig. 3.

If fuel flow is observed, the fuel pump is defective.

If no flow is observed, check the fuel shut-off at the fuel tank. (Be sure it is open.) Also check for a clogged strainer screen, blocked or pinched fuel line, plugged fuel tank vent in cap and be sure there is fuel in the tank.

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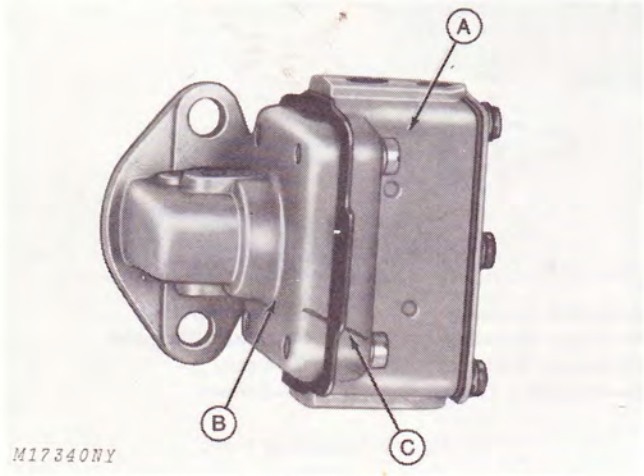
DISASSEMBLY AND REPAIR

Removal

Close the shut-off valve at the fuel tank. Remove the fuel lines from the fuel pump. Remove the mounting screws holding the pump to the engine.

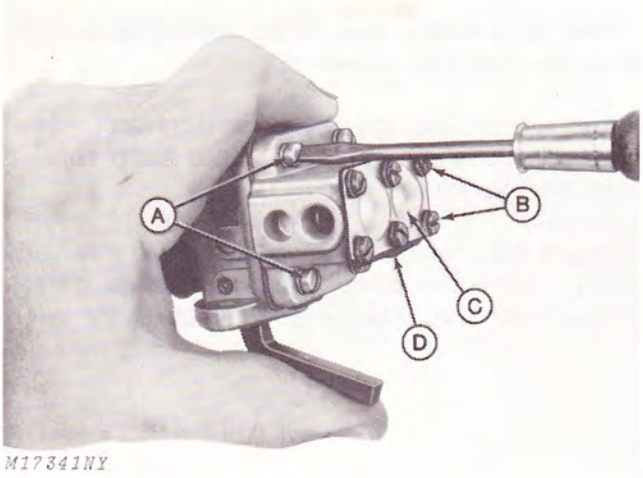
Disassembly



A—Upper Housing **B—Lower Housing** **C—Scribe Line**

Fig. 4-Fuel Pump

Before disassembly, scribe a line (C) across the upper housing (A), and lower housing (B), Fig. 4, to assure correct reassembly.



A—Cap Screws **C—Cover**
B—Screws **D—Upper Diaphragm**

Fig. 5-Disassembling Fuel Pump

Remove four cap screws (A) from the pump housing and separate the upper and lower halves of the pump.

Remove six screws (B) from the pump cover (C). Remove the cover (C) and upper diaphram (D), Fig. 5.

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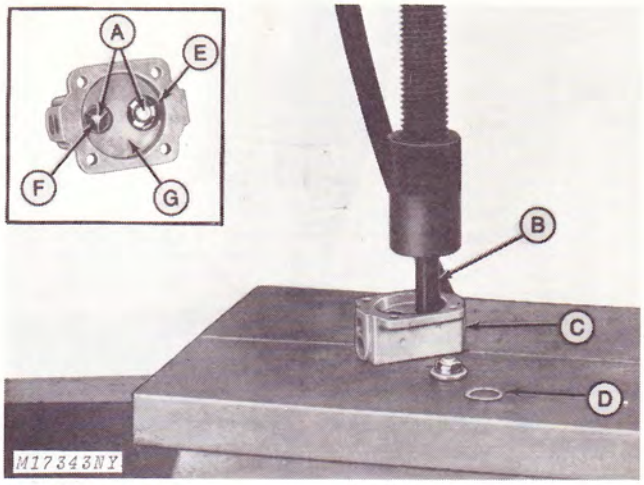


A—Check Valves **D—Gaskets**
B—Pilot **E—Inlet Port**
C—Upper Housing **F—Outlet Port**
G—Fuel Well

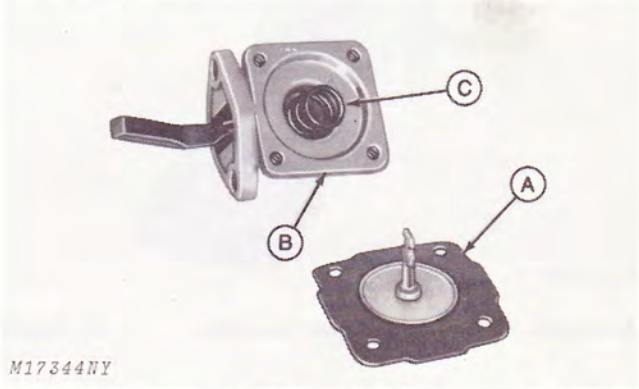
Fig. 6-Removing Check Valves

Note the position of both check valves (A) in the fuel pump (facing opposite each other). Check valve at the inlet port (E) faces away from fuel well (G). Check valve at the outlet port (F) faces toward the fuel well (G).

Position the pump in a press and using an appropriate pilot (B), press the check valves from the upper housing (C).

Remove the old check valve gaskets (D), Fig. 6.

NOTE: The check valves will be damaged when removed. New check valves are supplied in the pump repair kit.

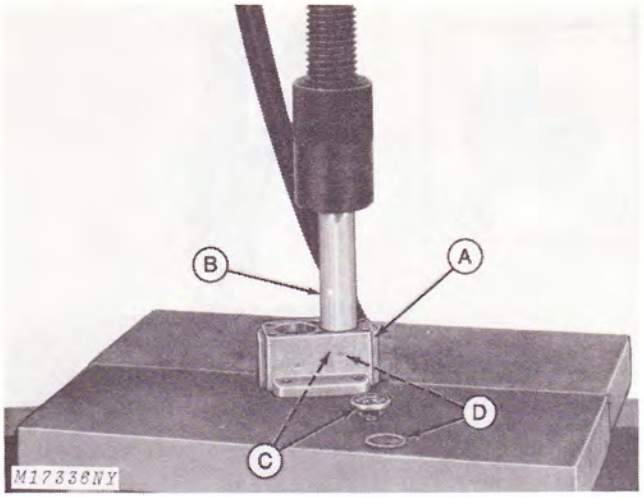


A—Diaphram **B—Lower Housing** **C—Spring**

Fig. 7-Removing Diaphram

Remove the diaphram (A) by turning it 90 degrees left or right. Remove diaphram spring (C) from lower housing (B), Fig. 7.

Assembly



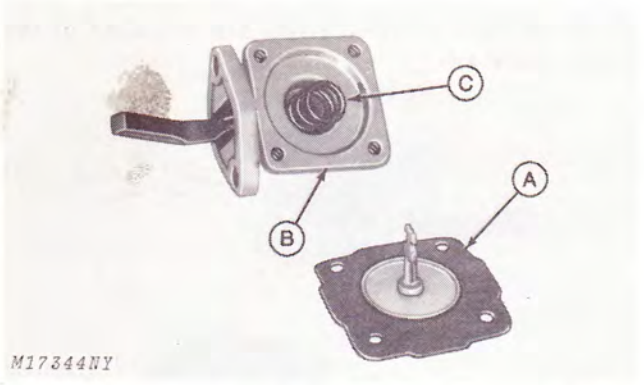
A—Upper Housing **C—Check Valves**
B—1/2-Inch Thin Wall Tubing **D—Gaskets**

Fig. 8-Pressing New Check Valves into Upper Housing

Place new gaskets (D) in upper housing (A), Fig. 8. Place upper housing on press with large holes facing up. Use a short piece of 1/2-inch thin wall tubing (B) to press new check valves (C) into housing until they bottom against the gaskets.

IMPORTANT: Replace check valves in same position as noted on page 30-25-3, Fig. 6.

NOTE: Press only on the outside edge of the check valves. The 1/2-inch thin wall tubing works well for this purpose.

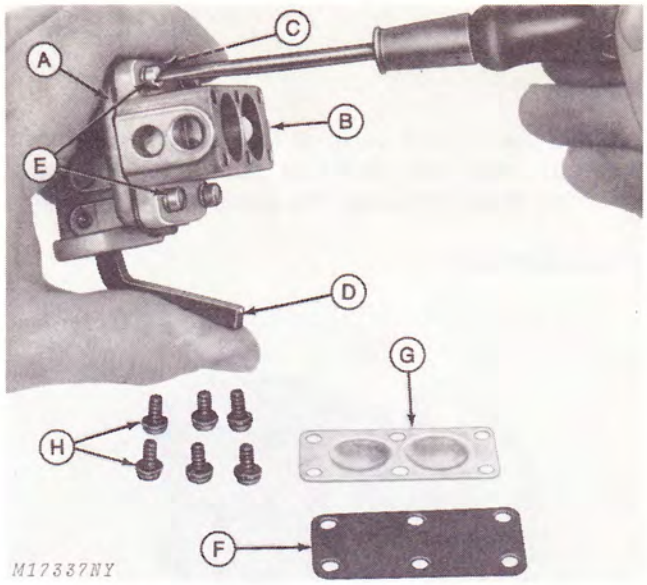


A—Diaphram **B—Lower Housing** **C—Spring**

Fig. 9-Installing Diaphram

Install spring (C) into lower housing (B).

Install diaphram into lower housing by pushing down on diaphram and turning it 90 degrees.



A—Lower Housing **E—Cap Screws**
B—Upper Housing **F—Upper Diaphram**
C—Scribe Marks **G—Cover**
D—Actuating Lever **H—Screws**

Fig. 10-Assembling Pump

Hold pump lower housing (A). Attach upper housing (B) to the lower housing aligning scribe marks (C). (DO NOT TIGHTEN.)

With hand on lower housing, push the actuating lever (D) up to the limit of its travel.

Hold the actuating lever in this position while tightening the four cap screws (E).

This will prevent stretching the diaphram. Attach upper diaphram (F) and cover (G) to pump housing using the six screws (H).

Mount the fuel pump on engine (note "IN" and "OUT" marked on pump) using new flange gasket. Connect fuel lines. Start engine and check for leaks.

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Section 40
ELECTRICAL SYSTEM
Group 5
GENERAL INFORMATION

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WIRING DIAGRAM
300 Tractor (Serial No. 30,001-70,000)

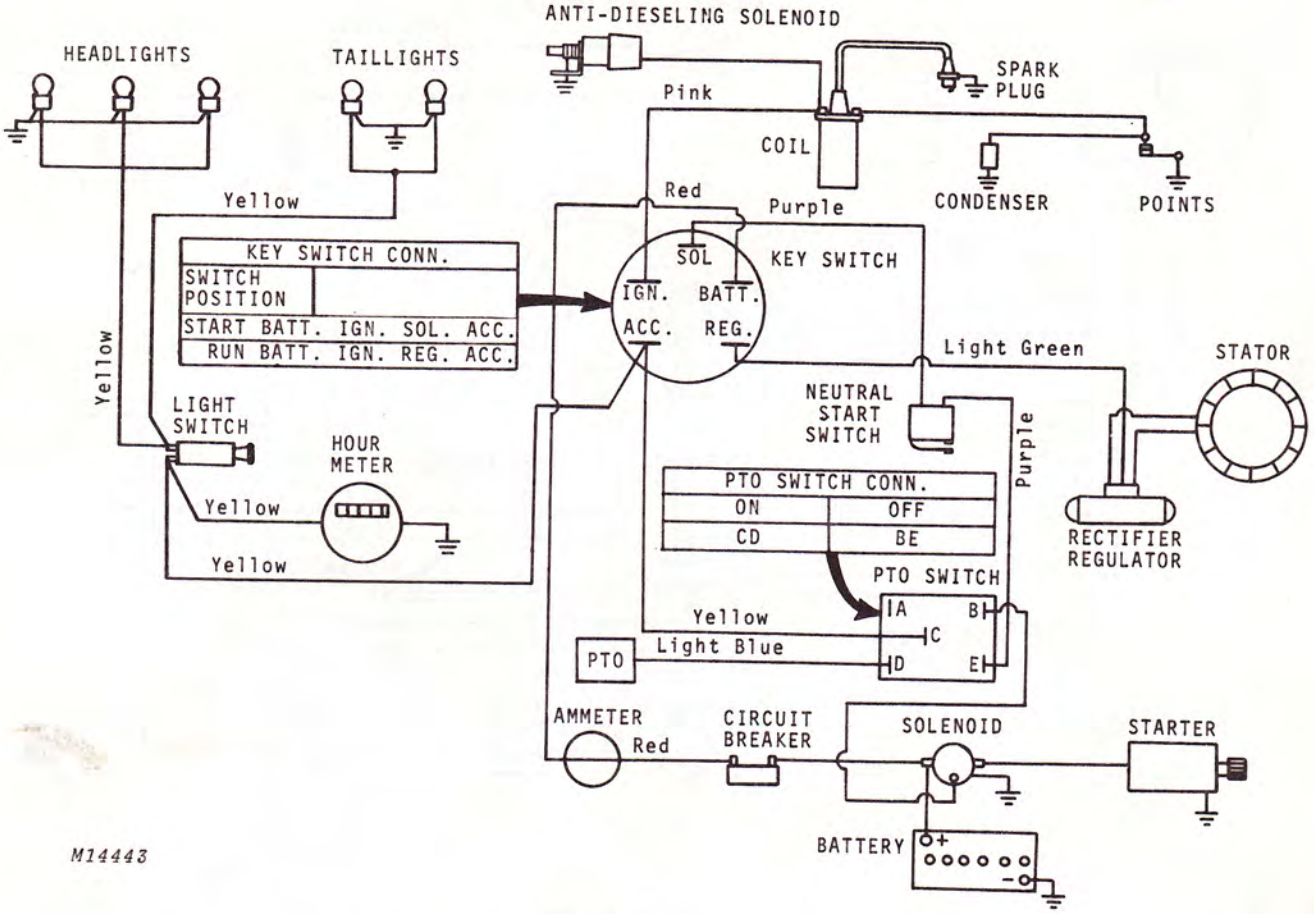

Fig. 1-Wiring Diagram

The 300 Tractor (Serial No. 30,001-70,000) has a 12-volt electrical system. The electrical system consists of the cranking, ignition and charging systems, plus the accessory circuits.

The cranking system consists of a battery, solenoid, circuit breaker, ammeter, key switch, two neutral-start safety switches and a permanent magnet starter motor. See Group 10 for detailed information.

The battery-coil ignition system is explained in detail in Group 15.

The battery is charged with a 15-amp alternator. A solid-state rectifier-regulator which converts AC (alternating current) from the alternator to DC (direct current) also controls the rate of charging current to the battery. See Group 20 for further information.

The accessory circuit consists of headlights, taillights, an hour-meter, and electric PTO clutch. Detailed information can be found in Group 25.

NOTE: The hour-meter is regular equipment on 300 Tractors (Serial No. 30,001-55,000) only.

WIRING DIAGRAM
300 Tractor (Serial No. 70,001-80,000) and 316 Tractor

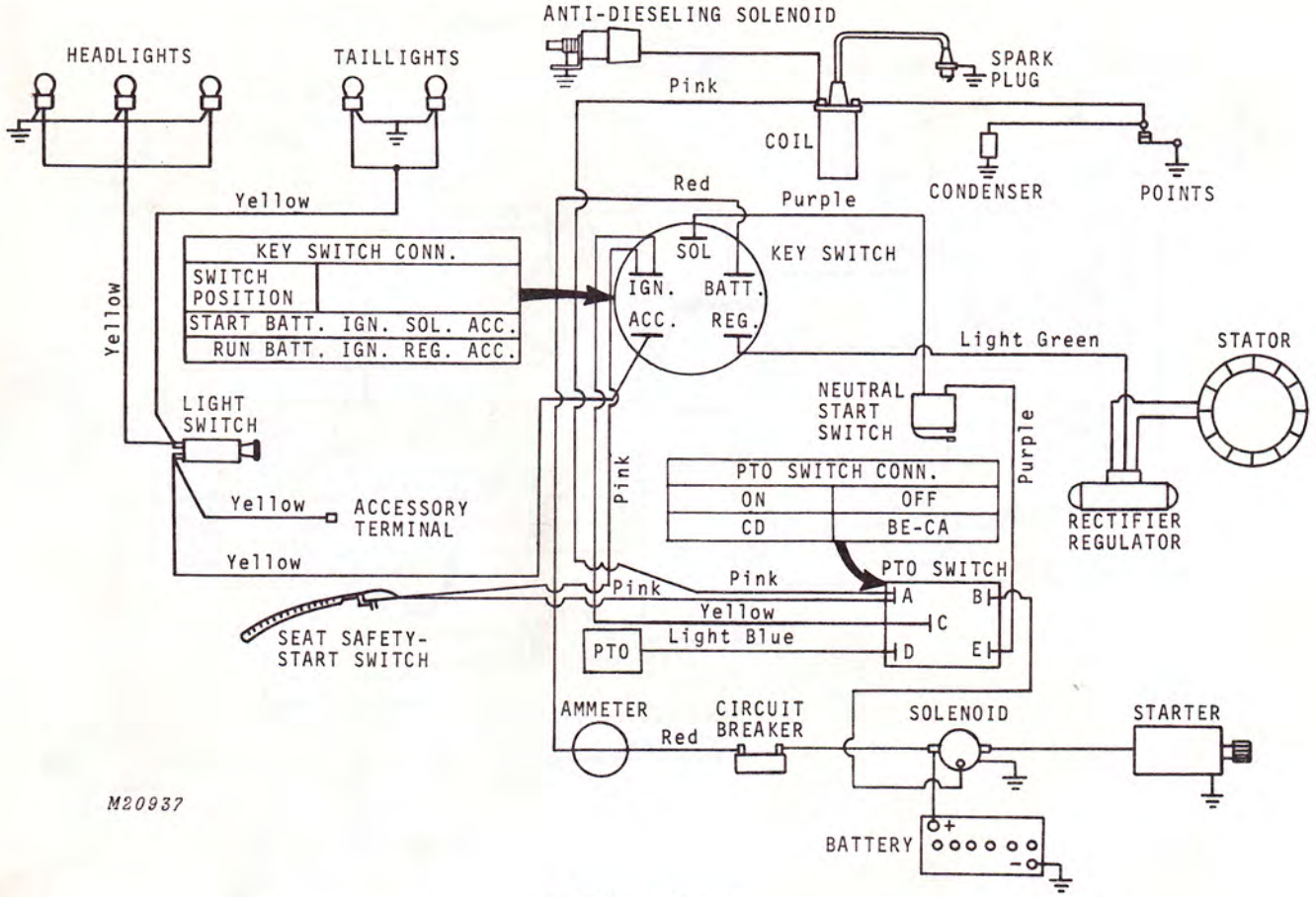

Fig. 2-Wiring Diagram

The 300 Tractor (Serial No. 70,001-80,000) and 316 Tractor have a 12-volt electrical system. The electrical system consists of the cranking, ignition and charging systems, plus the accessory circuit.

The cranking system consists of a battery, solenoid, circuit breaker, ammeter, key switch, two neutral-start safety switches and a permanent magnet starter motor. See Group 10 for detailed information.

The battery-coil ignition system is explained in detail in Group 15.

The battery is charged with a 15-amp alternator. A solid-state rectifier-regulator which converts AC (alternating current) from the alternator to DC (direct current) also controls the rate of charging current to the battery. See Group 20 for further information.

The accessory circuit consists of headlights, taillights, and electric PTO clutch. Detailed information can be found in Group 25.

NOTE: Some tractors may be equipped with a black PTO lead wire in place of the light blue PTO lead wire shown in Fig. 2 above.

WIRING DIAGRAM
312 and 314 Tractors

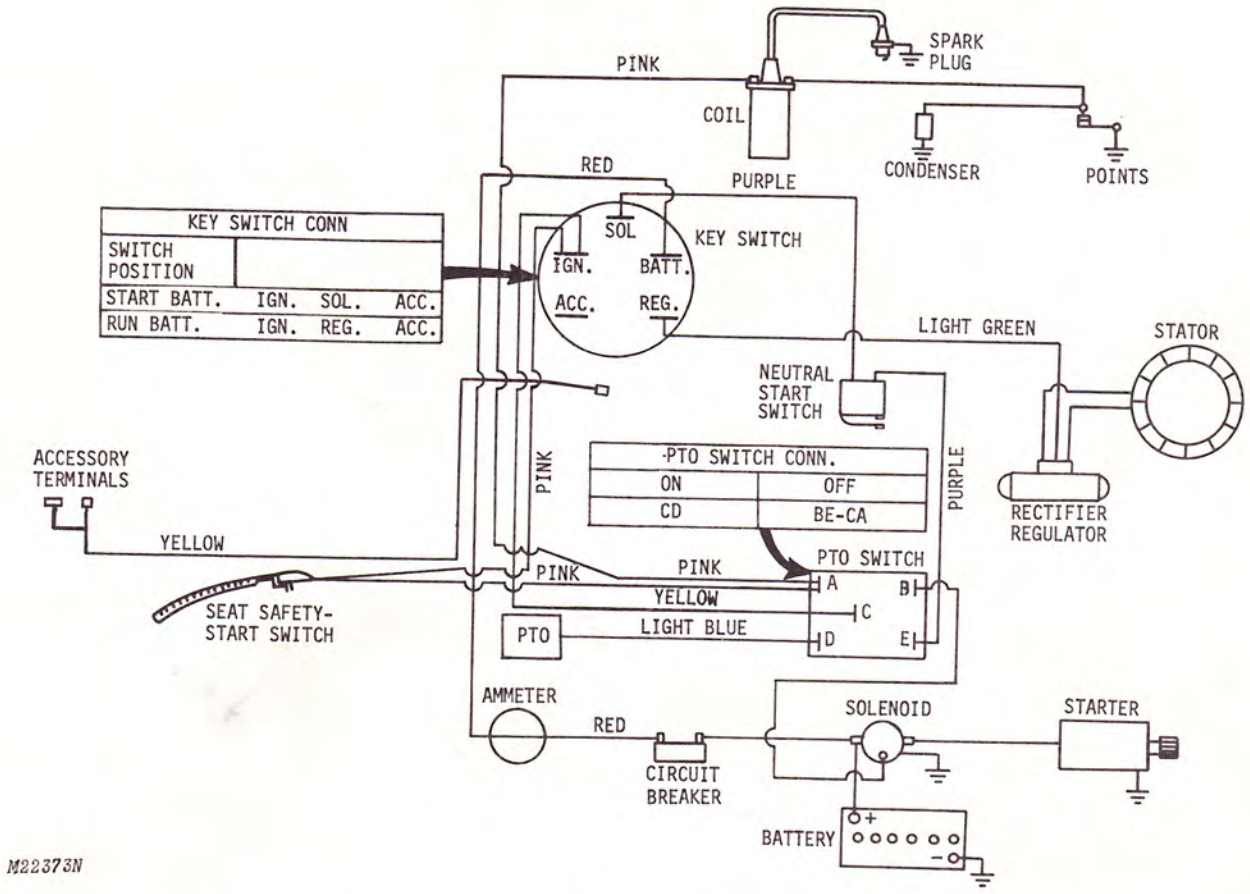

Fig. 3-Wiring Diagram

The 312 and 314 Tractors have a 12-volt electrical system. The electrical system consists of the cranking, ignition and charging systems, plus the accessory circuit.

The cranking system consists of a battery, solenoid, circuit breaker, key switch, three neutral-start safety switches and a permanent magnet starter motor. See Group 10 for detailed information.

The battery-coil ignition system is explained in detail in Group 15.

The battery is charged with a 15-amp alternator. A solid-state rectifier-regulator which converts AC (alternating current) from the alternator to DC (direct current) also controls the rate of charging current to the battery. See Group 20 for further information.

The accessory circuit consists of an electric PTO clutch. Some tractors may be equipped with a black PTO lead wire in place of the light blue PTO lead wire shown in Fig. 3 above. Detailed information can be found in Group 25.

NOTE: On 312 and 314 Tractors below Serial No. 120,001, accessory terminal lead wire is disconnected from accessory terminal on ignition switch to prevent accidental shorting of exposed terminal. If an accessory such as the headlight kit is installed, plug lead into accessory terminal on ignition switch.

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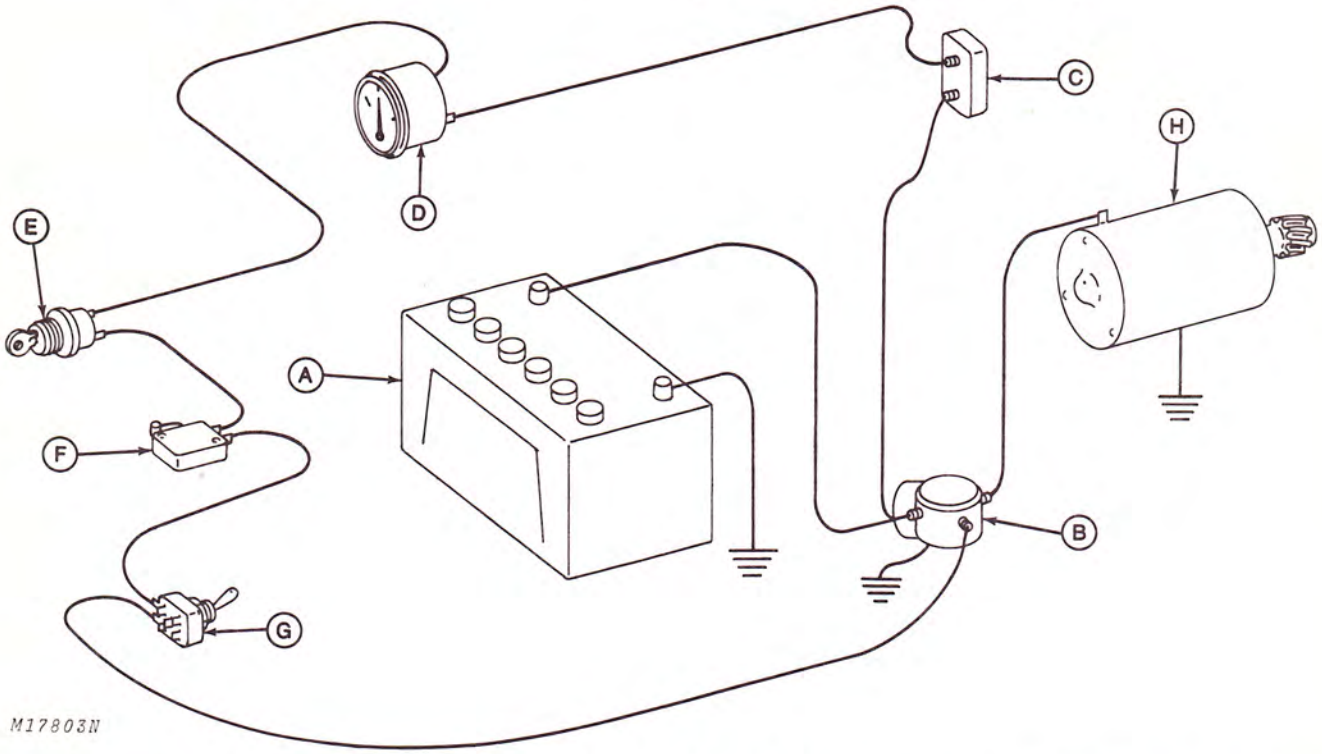
Group 10
CRANKING SYSTEM

PRINCIPLE OF OPERATION
Components For 300 Tractor (Serial No. 30,001-70,000)



A—Battery
B—Solenoid
C—Circuit Breaker
D—Ammeter
E—Key Switch
F—Transmission Neutral-Start Switch
G—PTO Neutral-Start Switch
H—Starter

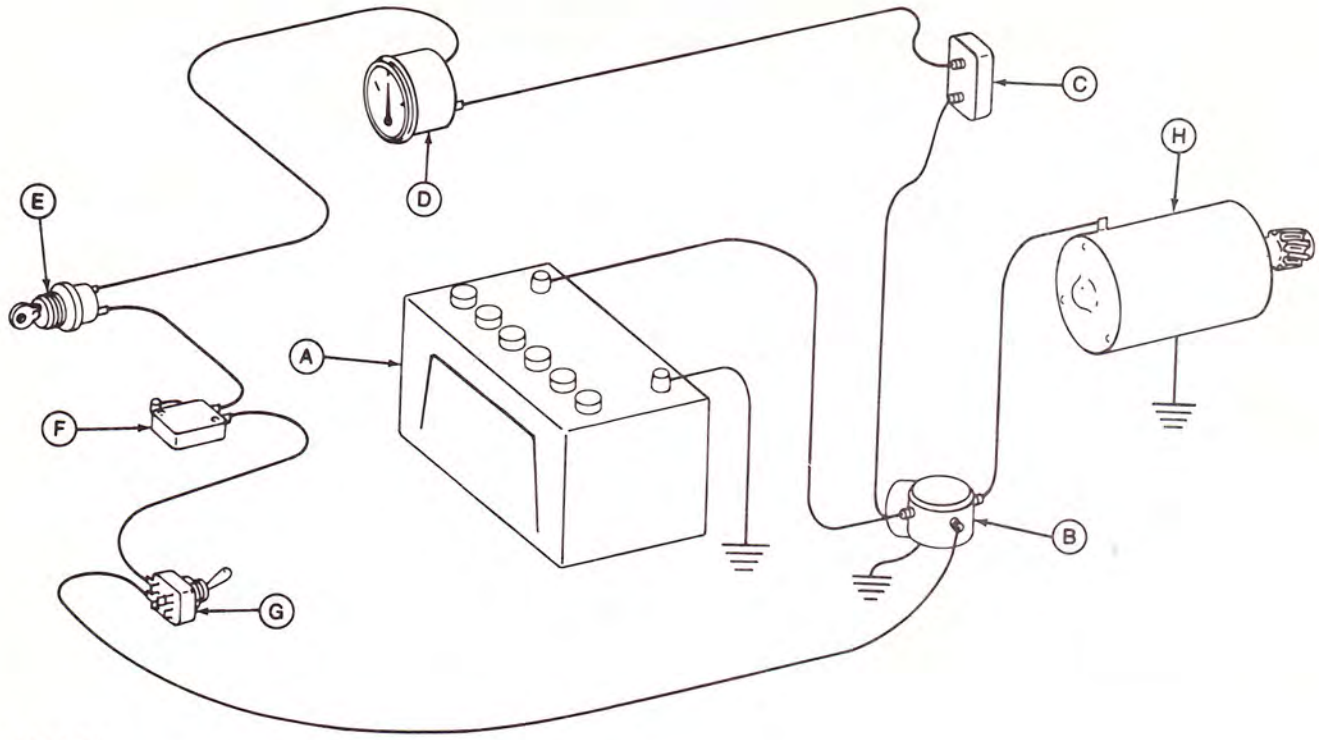
Fig. 1-Cranking System Components

The cranking system on the 300 Tractor (Serial No. 30,001-70,000) consists of a 12-volt battery (A), solenoid (B), circuit breaker (C), ammeter (D), key switch (E), two neutral-start safety switches (F and G) and a permanent magnet starter motor (H).

The two-neutral-safety start switches must be closed before the solenoid will activate the starter motor.

Litho in U.S.A.

PRINCIPLE OF OPERATION
Components For 300 Tractor (Serial No. 70,001-80,000) and 316 Tractor



M23231

A—Battery
B—Solenoid
C—Circuit Breaker
D—Ammeter
E—Key Switch
F—Transmission Neutral-Start Switch
G—PTO Neutral-Start Switch
H—Starter

Fig. 2-Cranking System Components

The cranking system on the 300 Tractor (Serial No. 70,001-80,000) and 316 Tractor consists of a 12-volt battery (A), solenoid (B), circuit breaker (C), ammeter (D), key switch (E), neutral-start safety switches (F and G) and a permanent magnet starter motor (H).

The neutral-safety start switches must be closed before the solenoid will activate the starter motor.

Battery

The storage battery is of the lead-acid variety. Lead is used in the construction of the cell plates and a sulfuric acid solution serves as the electrolyte.

Tractors are shipped from the factory with dry-charged batteries. This means the plates are charged, but electrolyte must be added just before using.

The 12-volt battery has a hard rubber case with six individual cells. Each cell contains a specific number of sets of negative and positive plates.

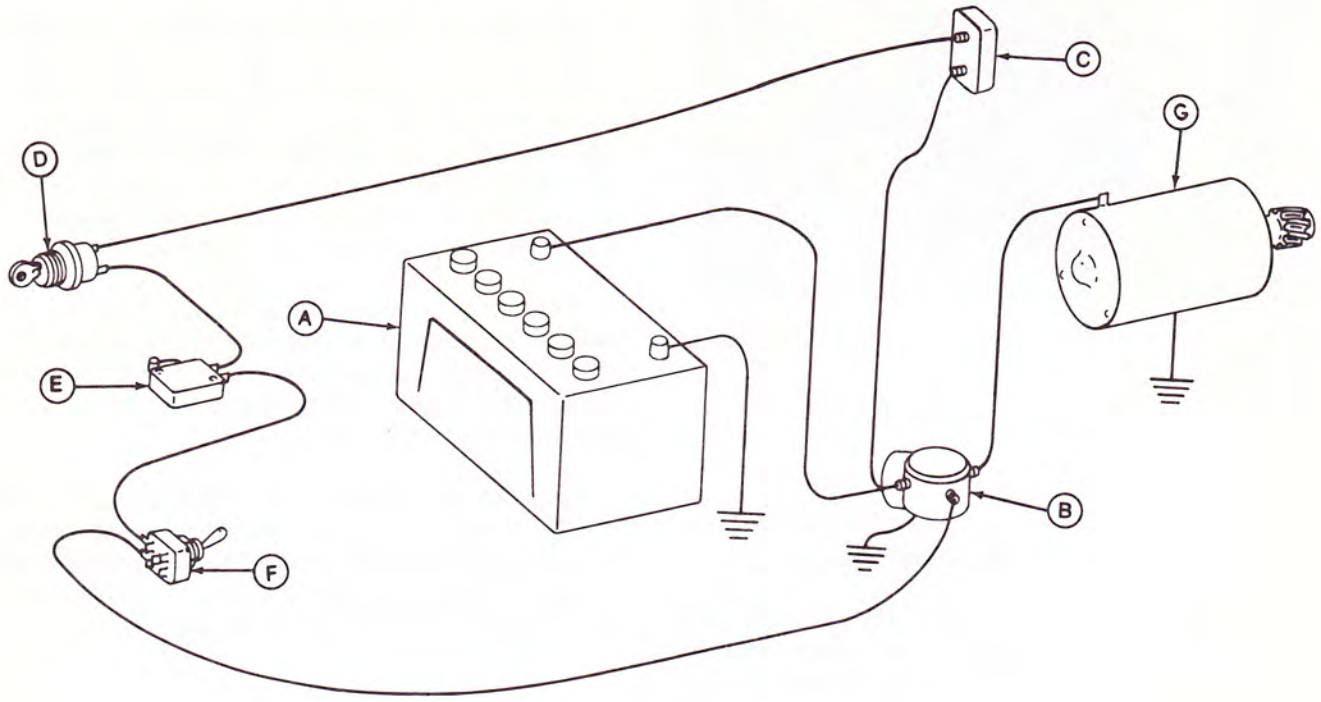
All plates of like charge are interconnected so that the accumulative charges are present at the positive and negative battery terminals.

As a battery discharges, lead sulfate deposits build up on the plates. This causes the specific gravity of the electrolyte to diminish. Charging the battery reverses the chemical reaction, restoring the electrolyte to original potential.

IMPORTANT: Avoid battery damage by charging at the manufacturer's recommended ampere-hour charging rate.

Litho in U.S.A.

PRINCIPLE OF OPERATION
Components For 312 and 314 Tractors



M23232

A—Battery
B—Solenoid
C—Circuit Breaker
D—Key Switch
E—Transmission Neutral-Start Switch
F—PTO Neutral-Start Switch
G—Starter

Fig. 3-Cranking System Components

The cranking system on the 312 and 314 Tractors, consists of a 12-volt battery (A), solenoid (B), circuit breaker (C), key switch (D), neutral-start safety switches (E and F) and a permanent magnet starter motor (G).

The neutral-safety start switches must be closed before the solenoid will activate the starter motor.

Battery

The storage battery is of the lead-acid variety. Lead is used in the construction of the cell plates and a sulfuric acid solution serves as the electrolyte.

Tractors are shipped from the factory with dry-charged batteries. This means the plates are charged, but electrolyte must be added just before using.

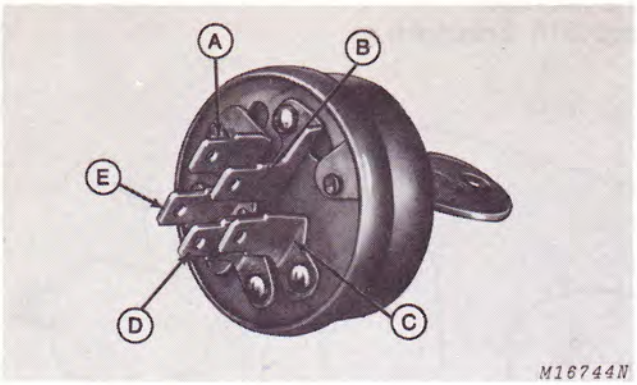
The 12-volt battery has a hard rubber case with six individual cells. Each cell contains a specific number of sets of negative and positive plates.

All plates of like charge are interconnected so that the accumulative charges are present at the positive and negative battery terminals.

As a battery discharges, lead sulfate deposits build up on the plates. This causes the specific gravity of the electrolyte to diminish. Charging the battery reverses the chemical reaction, restoring the electrolyte to original potential.

IMPORTANT: Avoid battery damage by charging at the manufacturer's recommended ampere-hour charging rate.

Litho in U.S.A.



A—Regulator **C—Solenoid** **E—Accessories**
B—Battery **D—Ignition**

Fig. 4-Ignition Switch Terminals

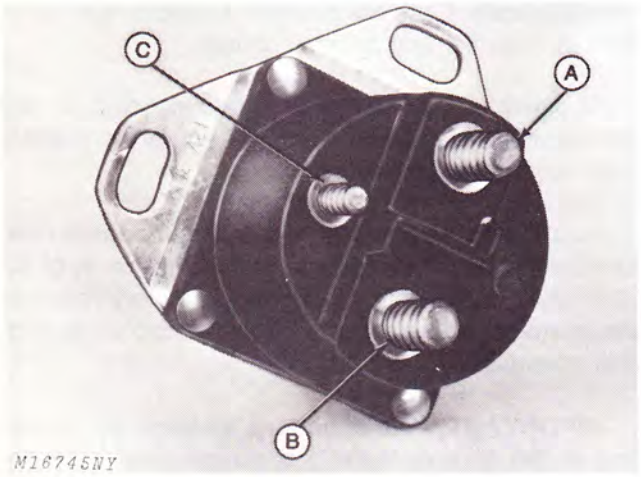
Ignition Switch

The ignition switch, Fig. 4, directs the flow of electricity from the battery to the proper circuit.

When the switch is in the "START" position (key turned all the way to the right) current is directed from the battery to the key switch, through the neutral-start safety switches to the starter solenoid.

When the switch returns to "RUN" position following engine start, current is diverted from the solenoid and routed to the accessory, charging and ignition circuits.

Solenoid



A—Positive Battery Terminal **C—Ignition Switch Terminal**
B—Starter Terminal

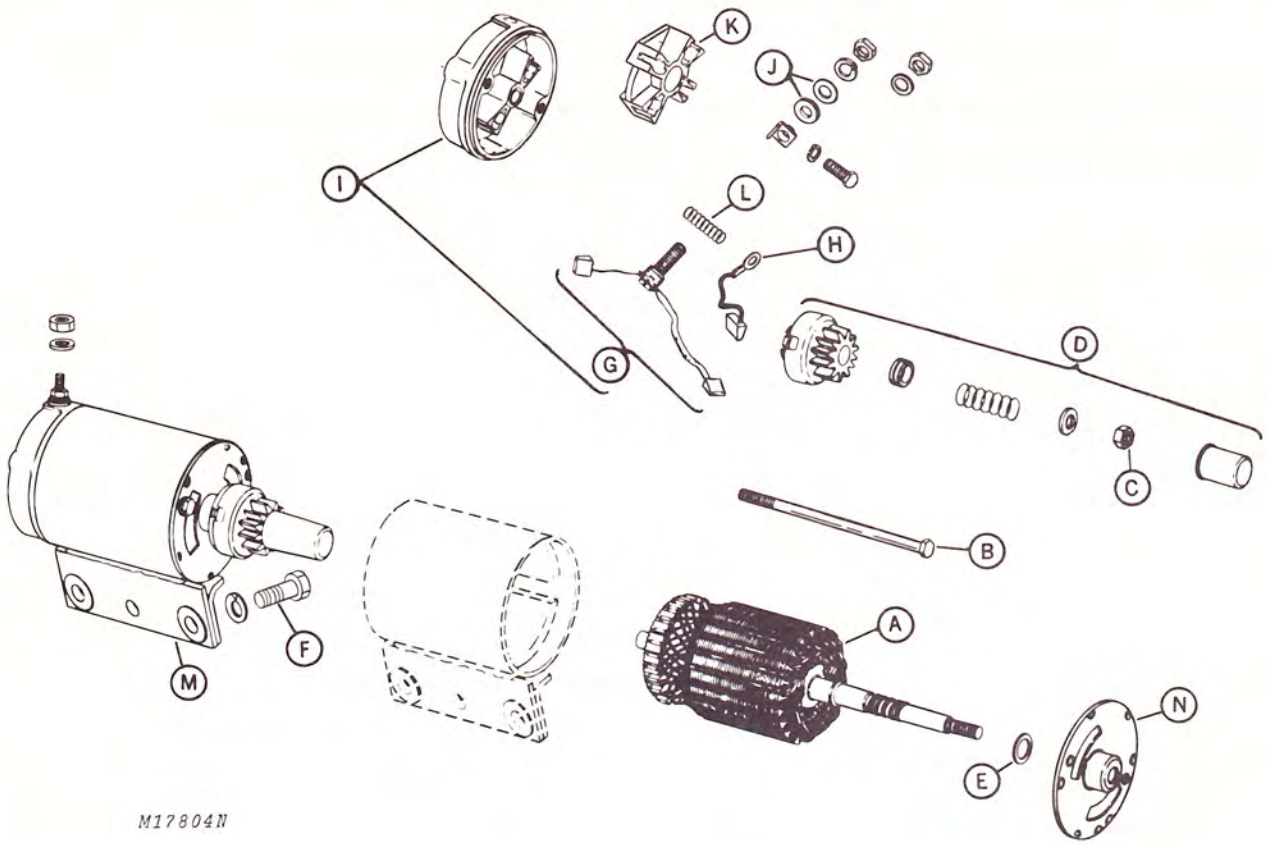
Fig. 5-Solenoid Terminals

The solenoid, Fig. 5, is an electric switch composed of an electromagnet and spring-loaded plunger.

One large terminal (A) is connected to the positive terminal of the battery and the other terminal (B) is connected to the starter terminal. The solenoid case is grounded to the frame, as is the negative post of the battery. When the ignition switch is turned to the "START" position, current flows through the solenoid windings forming a complete circuit with the grounded case and setting up an electromagnetic field.

This draws the plunger into the center of the field, overcoming a spring around the plunger. A contact on the end of the plunger closes the circuit across the battery and starter contact points permitting current flow from the battery to the starter.

Once the key switch is permitted to return to the "RUN" position, current is cut off from the solenoid collapsing the electromagnetic field. The spring-loaded plunger moves away from the contact point breaking the circuit from the battery to the starter.



A—Armature
B—Thru Bolt
C—Retaining Nut
D—Drive Assembly
E—Spacer
F—Shoulder Bolt
G—Brush and Stud Assembly
H—Brush
I —End Cap
J —Insulators
K—Brush Holder
L —Brush Spring
M—Housing
N—Drive End Cap

Fig. 6-Exploded View of Starter

Starter

The permanent magnet starter used on the 300, 312, 314 and 316 Tractors, Fig. 6, differs from a wire-wound starter in construction, current requirement and torque characteristics.

On wire-wound starters, a relatively heavy current is directed through the field coil and armature to build up a strong magnetic field necessary to start the armature turning.

The permanent magnet starter needs current only for the armature in order to set up opposing magnetic fields to start it turning.

The starter drive (D), Fig. 6, consists of the starter drive gear and spring which are mounted onto the armature shaft. When the armature (A) turns, the drive gear moves laterally into mesh with the flywheel. As the engine starts and speeds up, the armature is overrun, causing the drive gear to disengage.

Litho in U.S.A.

DIAGNOSING AND TESTING

PROBLEM	TEST SEQUENCE
1. Engine cranks but does not start.	Problem in ignition system (see page 40-15-8).
2. Engine cranks short time only.	A. Test battery B. Check connections C. Test starter
3. Engine cranks slowly.	A. Test battery B. Check connections C. Test starter
4. Engine does not crank.	A. Test battery B. Check connections (also check circuit breaker, page 40-20-4) C. Test starter D. Test solenoid E. Test neutral-start safety switches F. Test ignition switch

Cranking System Tests

Test A. Test Battery

1. Check battery specific gravity, page 40-10-7. If battery is good, proceed to next test.
   If discharged, charge battery.
   If battery is in poor condition, replace battery.
2. Check battery voltage, page 40-10-7.
   If good, proceed to next test.
   If poor, replace battery.

Test B. Check Connections

1. Check all connections for looseness, corrosion, or breaks.

Test C. Test Starter

1. Connect battery directly to starter.
   If starter cranks engine, proceed to test solenoid, neutral-start safety switches and ignition switch.
   If starter does not energize, remove starter from the tractor and test as instructed on page 40-10-10.
   If starter engages, but does not crank engine: Check for engine resistance such as seized piston, binding connecting rod, crankshaft bearings, or bushings. If engine and PTO turn freely, remove starter and check it for a dirty or gummed armature, shorted or grounded armature, or misaligned starter motor.

Test D. Test Solenoid

Connect battery directly to solenoid, page 40-10-10. If solenoid energizes, test neutral-start safety switches. If solenoid fails to energize, replace solenoid.

Test E. Test Neutral-Start Safety Switches

Transmission Neutral-Start Safety Switch

Attach test light to the terminals, page 40-10-8. Place the hydrostatic control lever in neutral position. If test light lights, test the PTO switch. If test light does not light, adjust switch as explained on page 40-10-8. If test light does not light after adjustment, replace neutral-start switch.

PTO Neutral-Start Safety Switch

Remove connector with purple wires from the PTO switch. Attach test light to terminals on switch, page 40-10-9. Place PTO switch in the "OFF" position.
If test light lights, test ignition switch.
If test light does not light, replace neutral-start switch.

Litho in U.S.A.

Test F. Test Ignition Switch

Check for continuity between terminals with the switch placed in each of three positions as explained on page 40-10-8.

Testing Battery

(Checking Battery Specific Gravity)

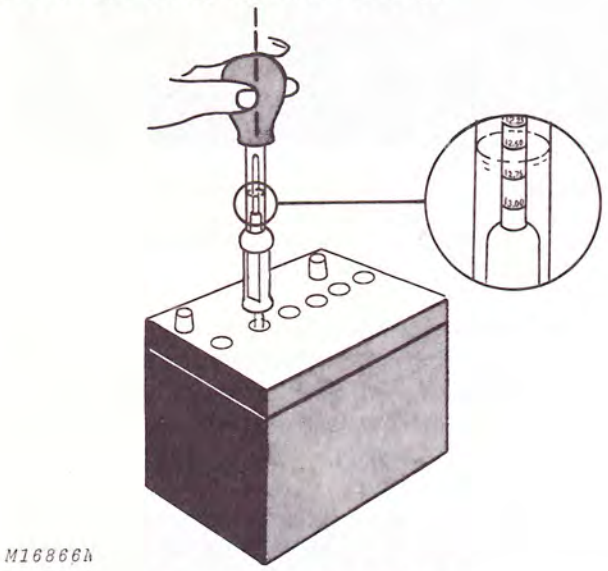


Fig. 7-Checking Specific Gravity

To determine whether the battery is capable of meeting the requirements of the starting motor, it is necessary to duplicate operating conditions by subjecting the battery to a load test (checking battery voltage). To obtain a true test, the battery should be at least 75 percent charged. This can be determined by taking a hydrometer reading, Fig. 7.

The following table illustrates typical ranges of specific gravity (amount of unused sulfuric acid remaining in the solution) for a cell in various states of charge, with respect to its ability to crank the engine at 80°F (26.5°C) with initial full-charge specific gravity at 1.260 to 1.280.

Specific Gravity	Capacity
1.260 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.140 to 1.160	Very little useful capacity
1.110 to 1.130	Discharged

Checking Battery Voltage

With a battery in good condition, each cell contributes approximately 1.95 to 2.08 volts. If battery charge is low and less than 0.05 volt difference is noted between the highest and lowest cells, the battery may be recharged.

If this difference is more than 0.05 volts, this could indicate a cracked plate or other damage which could call for replacement of the battery.

There are two methods of testing battery capacity. Battery electrolyte temperature should be at or near 80°F (26.5°C) for these tests.

Before making either of the two following tests, first check electrolyte level in battery. Add water if necessary. If water is added, be sure it is thoroughly mixed with the underlying electrolyte by charging. Battery voltage should be 11.5 to 12.6 volts before testing. Refer to instructions supplied by test equipment manufacturer, when using high-rate discharge equipment.

The first method of testing should be to crank the engine for 15 seconds with the starting motor then measure the battery voltage. If voltage is less than 9.6 volts at the end of 15 seconds cranking, replace battery.

As a second method, use high-rate discharge test equipment. Discharge the battery by means of a heavy-duty carbon pile at a rate 3 times the ampere-hour capacity. Follow equipment manufacturer's recommendations for testing.

If after 15 seconds the battery voltage is less than 9.0 volts, the battery fails to meet the load test, indicating loss of capacity of internal short circuits. Any battery that passes the load test is a good battery and can be relied upon to fulfill the requirements of the starting motor under normal conditions.

Litho in U.S.A.

Testing Ignition Switch

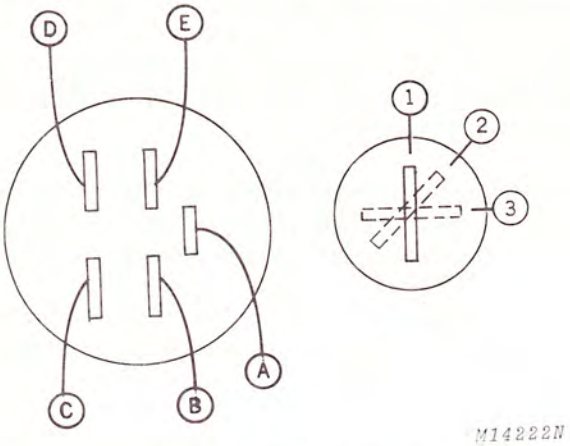


Fig. 8-Test Ignition Switch

Remove battery to provide access. Remove coupler from ignition switch to expose terminals. The ignition switch can be tested with a test light. Check for continuity between terminals with switch placed in each of three positions. See Fig. 8, and chart below for current flow diagram. If switch is defective, it must be replaced.

POSITION	CLOSED	OPEN
1 - OFF	-	A, B, C, D, E
2 - RUN	B, C, D, E	A
3 - START	A, B, D, E	C

Testing Neutral-Start Safety Switches

300 Tractors (Serial No. 30,001-70,000) are equipped with a PTO and transmission neutral-start safety switch. 300 Tractors (Serial No. 70,001-80,000), and 312 and 316 Tractors are equipped with a PTO, transmission, and seat neutral-start safety switch. All neutral-start safety switches must be closed to allow current to flow to the starter solenoid.

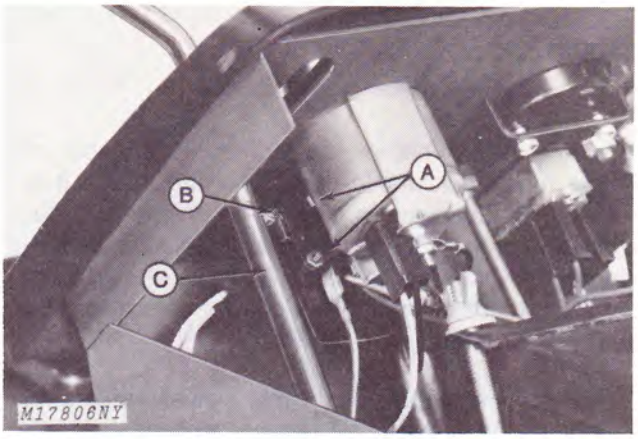
The PTO and seat neutral-start safety switch circuitry prevents the engine from running when the operator leaves the seat with the PTO engaged.

The transmission neutral-start safety switch can be adjusted. If the solenoid will not activate when the PTO switch is in the "OFF" position, and the hydrostatic control lever is in "NEUTRAL", check for proper adjustment at the hydrostatic control lever switch.

A—Test Light **B—Switch Leads**

Fig. 9-Testing Transmission Neutral-Start Safety Switch

To test, connect a test light (A) to the switch leads (B) as shown. Place the hydrostatic control lever in neutral position. If test light does not glow, check adjustment. If test light fails to glow after adjusting switch, replace the switch.



A—Nuts **B—Roller** **C—Hydrostatic Control Lever**

Fig. 10-Adjusting Transmission Neutral-Start Safety Switch

To adjust, place hydrostatic control lever (C) in neutral position. Loosen nuts (A) at switch and move switch in slots so the roller (B) is depressed causing the switch to "click".

IMPORTANT: Do not adjust so roller (B) is bottomed because this could cause damage or premature failure of the switch.

Testing PTO Switch Cranking Circuit

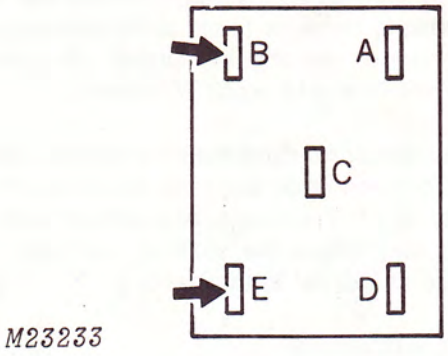


Fig. 11-Testing PTO Switch Cranking Circuit

To test the PTO switch cranking circuit, remove the two-terminal connector from the switch and attach a test light to the terminals shown in Fig. 11. The light should light with the switch in the "OFF" position. If the light fails to light, replace the switch.

Testing PTO Switch Power Circuit

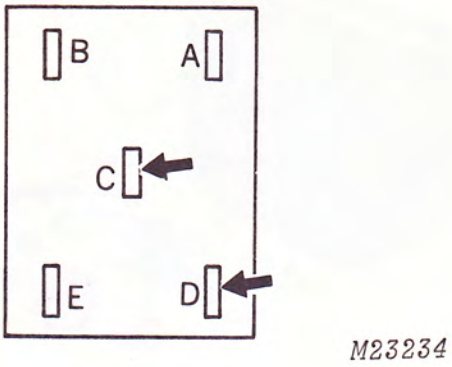
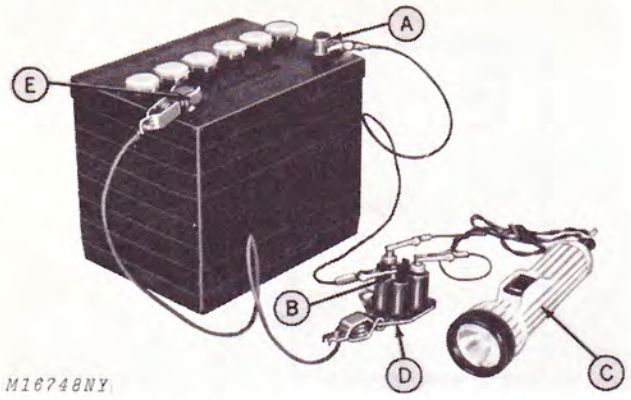


Fig. 12-Testing PTO Switch Power Circuit

To test the PTO switch power circuit, remove the three-terminal connector, attach a test light to terminals shown in Fig. 12, and move toggle to "ON" position. The test light should light. If test light fails to light, replace the switch.

Testing Solenoid



A—Positive Battery Terminal
B—Ignition Switch Terminal
C—Test Light
D—Solenoid Base
E—Negative Battery Terminal

Fig. 13-Testing Solenoid

To test the solenoid, connect jumper wires from the negative battery terminal (E, Fig. 13), to the solenoid base (D), and from the positive battery terminal (A) to the ignition switch terminal (B) at the solenoid. Connect a test light (C) between the two large terminals on the solenoid, Fig. 13. The light should light when the solenoid is activated.

Testing Starter

If the starter fails to crank properly when the engine is known to be in good operating condition and the rest of the cranking circuit is found to be satisfactory, remove the starter and check if further. (See page 40-10-13 for removal and repair of starter.)

With the starter removed from the engine, check the armature for freedom of operation by turning the shaft. Tight, dirty or worn bushings, or a bent or worn armature shaft may cause the shaft to turn hard. Disassemble the starter for further testing.

Testing Armature

If inspection does not reveal the cause of failure, test the armature for opens, shorts, and grounds as follows:

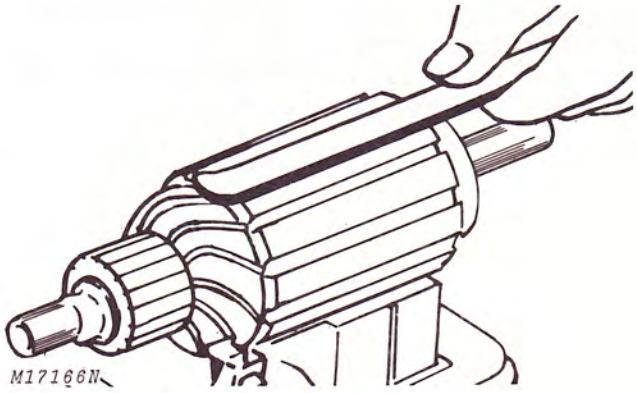


Fig. 14-Testing Armature for Shorts

1. SHORTS - A burned commutator bar indicates a shorted armature. Short circuits are located by rotating the armature on a growler with a steel strip (hack-saw blade) held on the armature, Fig. 14. The steel strip will vibrate on the area of the short circuit.

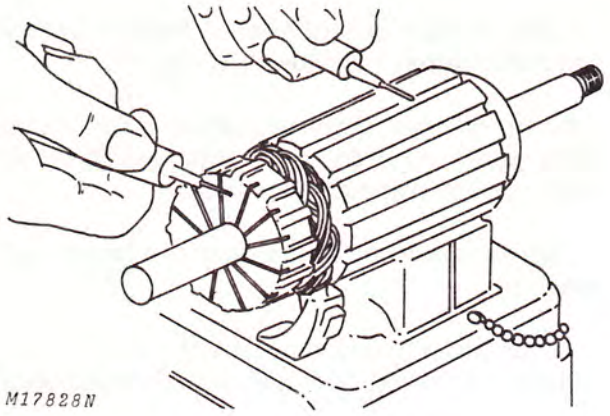


Fig. 15-Testing for Grounds

2. GROUNDS - Grounds in the armature can be detected with a test lamp and probes, Fig. 15. If the lamp lights when one test probe is placed on the commutator and the other probe on the armature core or shaft, the armature is grounded.

3. OPENS - Inspect for loose connections at the point where the armature windings are attached to the commutator bars. Poor connections cause arcing and burning of the commutator. Resolder any poor connections and turn armature in a lathe to provide a good surface for brushes.

If tests reveal any of the above-listed conditions other than a repairable open circuit, replace the armature.

REPAIR

Battery

Removing Battery

Loosen bolts through terminal clamps. Use a terminal puller to remove clamps. If a terminal puller is not available, spread clamps before prying them off battery posts.

To avoid injury from a spark or short circuit, disconnect cable from the negative battery terminal first. Then remove terminal cover from positive terminal and disconnect cable from positive terminal.

Servicing Battery

Good battery servicing should include the following items:

1. Clean battery.
2. Inspect cables including ground connections.
3. Clean terminals.
4. Inspect hold-downs.
5. Inspect case for leaks.
6. Make hydrometer test.
7. Add water if necessary. Use caution to protect tractor from electrolyte damage.
8. Recharge battery if less than 75 percent charged.

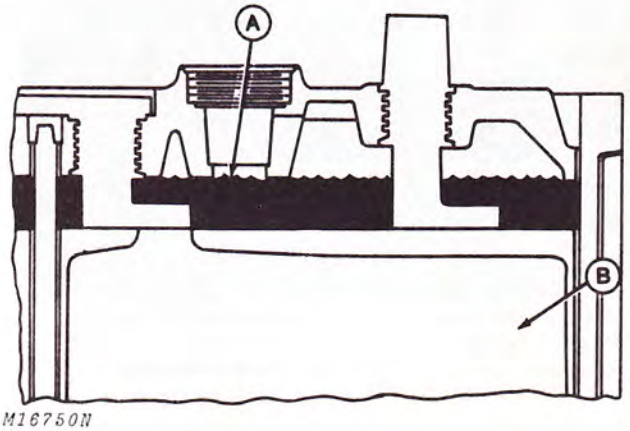
Activating New Battery

When activating a new battery, remove battery from tractor when filling it with electrolyte. This will prevent damage to tractor in case electrolyte spills.

Add electrolyte until plates are just covered. Then charge at 30 to 40 amps for 10 minutes or 15 amps for 30 minutes.

Charging the battery will increase battery temperature and raise the electrolyte level. If electrolyte is still below the ring in the filler neck (A), add enough electrolyte to fill battery to the bottom of the ring. See Fig. 16.

CAUTION: After the battery is activated, hydrogen and oxygen gases in the battery are very explosive. Therefore, it is necessary to keep open flames and sparks away from battery.



A—Filler Neck **B—Battery Plates**

Fig. 16-Proper Level of Electrolyte in Battery Cells

Checking Battery Electrolyte Level

Periodically check the level of the electrolyte in the battery cells. This should be done at least once a week during peak operating periods.

Proper level is normally to the bottom of the ring in the filler neck (A) so that the tops of the battery plates (B) are covered, Fig. 16. Do not overfill.

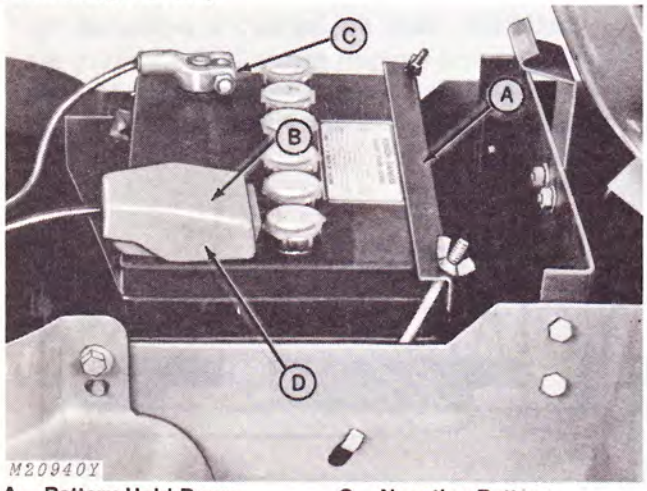
Add only distilled water to the battery. If not available, be sure to use clean, soft water. Avoid water with a high mineral content.

Never add acid to the battery unless electrolyte is lost by spilling. To add acid to the battery will unbalance the 10 to 1 sulfuric acid-to-water ratio.

Always wait until after checking specific gravity before adding water to the battery. This will assure a true reading. If level is too low to check specific gravity, add water and operate system for a few minutes to mix water and electrolyte, then check.

In freezing weather, never add water to the battery unless tractor will be operated for a period of time to allow mixing of the water and electrolyte.

Installing Battery



A—Battery Hold-Down
B—Positive Battery Terminal
C—Negative Battery Terminal
D—Positive Battery Terminal Cover

Fig. 17-Installing Battery

Clean and dry battery exterior. Position battery and install battery hold-down (A), Fig. 17.

Never hammer terminal clamps onto battery posts when connecting battery cables. To do so could result in damage to the battery.

Attach positive cable to positive (+) battery terminal (B).

Attach ground cable to negative (−) battery terminal (C). Coat both terminals with petroleum jelly.

IMPORTANT: Place battery terminal cover (D) or rubber boot over positive battery terminal (B) until terminal and clamp are completely covered.

Be sure top and bottom vent holes in each cell cap are open.

IMPORTANT: Fast charging, welding, or reversing polarity can damage alternator-stator or rectifier-regulator. Always connect positive cable to positive post, and negative cable to negative post. Disconnect connector from rectifier-regulator before charging, jumping, or welding. Charging can damage coil if key switch is left on.

Cleaning Battery

Corrosion around the battery terminals is normal. However, an accumulation of corrosion over a long period can shorten the life of the battery. It is therefore important to keep battery terminals as clean as possible. Corrosion across the top of the battery can discharge the battery.

To clean terminals, remove battery from tractor. Remove all corrosion using a wire brush. Wash terminals using a solution of one part ordinary baking soda to four parts water. Do not permit cleaning solution to enter battery cells.

Wash entire battery case, battery base and hold-down strap with clear water.

REPAIR

Starter

Removing Starter

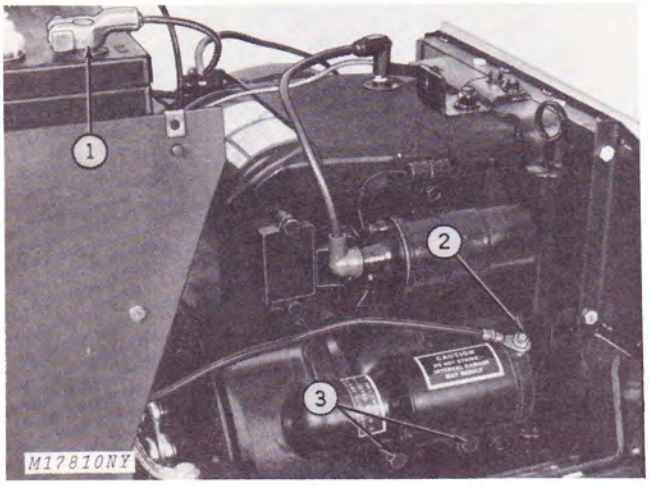


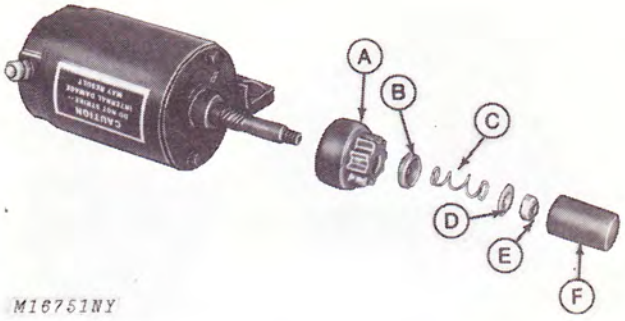
Fig. 18-Removing Starter

1. Raise hood and disconnect the ground cable from the negative battery terminal, Fig. 18.

2. Remove the right-hand side panel and disconnect the lead from the starter motor, Fig. 18.

3. Remove the two bolts from the starter mounting bracket; then, remove the starter from the engine.

Disassembling Starter

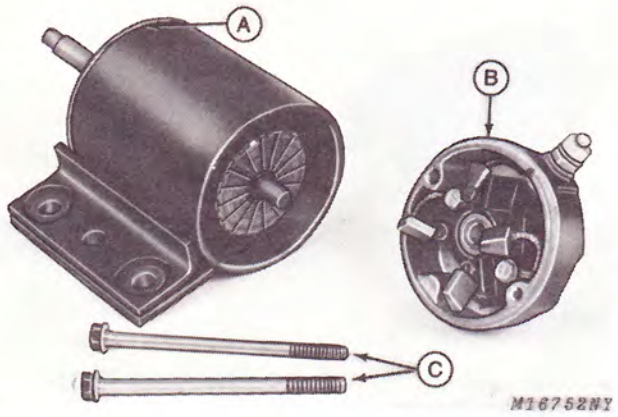


A—Drive Gear
B—Gear Stop Spacer
C—Anti-Drift Spring
D—Dust Cover Spacer
E—Stop Nut
F—Dust Cover

Fig. 19-Disassembling Starter Drive

Remove dust cover (F) from end of starter drive, Fig. 19. Hold drive gear (A) and remove 3/8-inch stop nut (E). Remove drive parts from armature shaft.

REPAIR—Continued



A—Drive End Cap
B—Commutator End Cap
C—Thru Bolts

Fig. 20-Disassembling Starter

Remove the two thru bolts (C) which hold the end caps (A) and (B) to starter housing, Fig. 20.

Remove commutator end cap (B) carefully, Fig. 20, to avoid losing brush springs which may pop out when the end cap is removed.

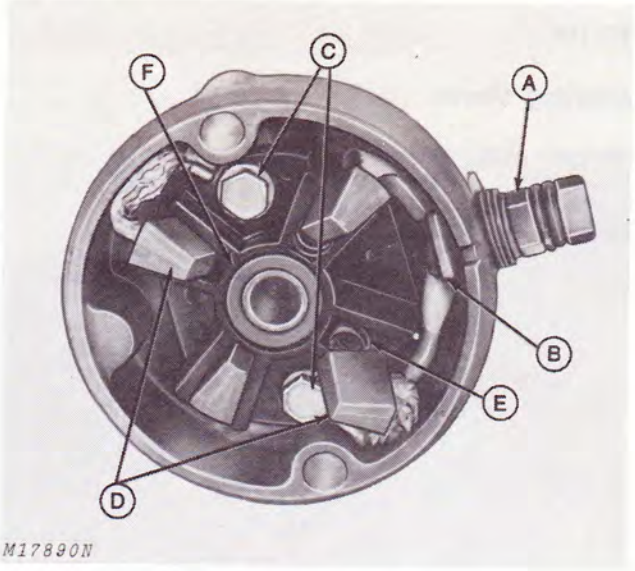
Inspecting Starter

Clean and inspect starter drive components for excessive wear. Replace parts as necessary.

See "Testing Starter" on page 40-10-10.

Inspect bearing in mounting bracket and end cap. Also inspect armature shaft. If armature shaft has excessive play in bearings, replace end caps. It may be necessary to replace armature if bearing surfaces are worn badly. Excessive bearing play will allow armature to rub against fields.

Clean and inspect commutator. If surfaces are badly grooved, true up on a lathe and undercut mica. Brushes must make good contact with commutator.



A—Nuts, Washers and Seal
B—Brush Assembly
C—Screws
D—Brush
E—Spring
F—Brush Holder

Fig. 21-Replacing Brushes

Remove nuts, washers and seal, (A), Fig. 21.

Remove brush assembly (B).

Remove two screws (C).

Remove two brushes (D).

Remove four springs (E).

Replace brush holder (F) if necessary.

Install four springs (E).

Install two brushes (D) with two screws (C).

Install brush assembly (B).

Install nuts, washers and seal (A).

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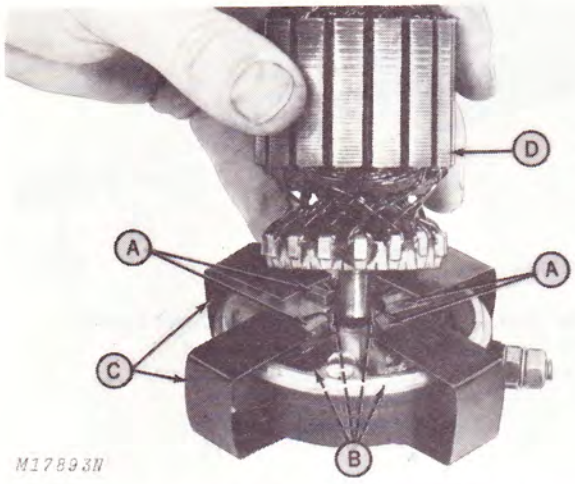
Assembling Starter



A—Brush B—Springs C—Retaining Clips D—Armature

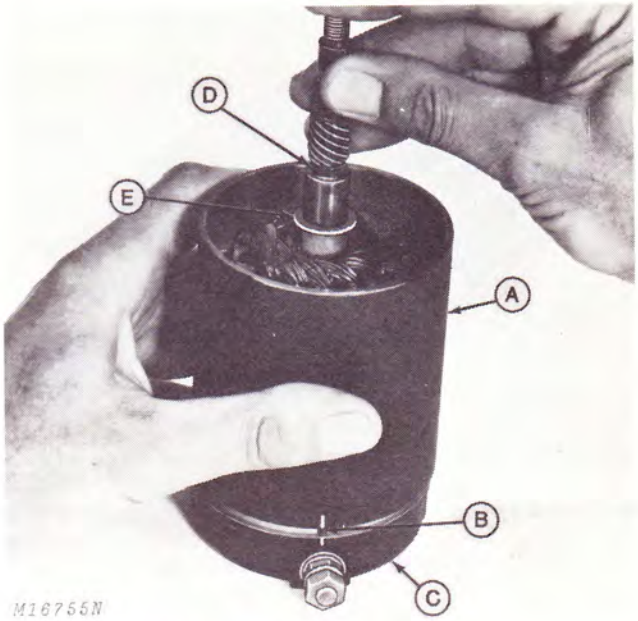
Fig. 22-Installing Brushes

Place brushes (A) in their proper locations in the brush holder, Fig. 22 with the beveled side of brush up.

Compress springs (B) and place U-shaped retaining clips (C), made of banding steel, over each brush.

Wipe commutator clean with a dry cloth and lubricate armature shaft with a small amount of light grease.

Place armature (D) in end cap, Fig. 22, and remove retaining clips.



A—Starter Housing
B—Index Marks
C—Commutator End Cap
D—Armature
E—Thrust Washer

Fig. 23-Aligning Index Marks

Place starter housing (A) over armature (D) while exerting down pressure on the armature, Fig. 23. This prevents brush springs from pushing armature up and away from end cap (C). If this occurs, reload brushes into end cap and reassemble.

Align housing (A) with end cap (C) using the index marks (B) on cap and housing as a guide, Fig. 23.

Place thrust washer (E) onto armature shaft, Fig. 23. Lubricate drive end cap bearing with light grease.

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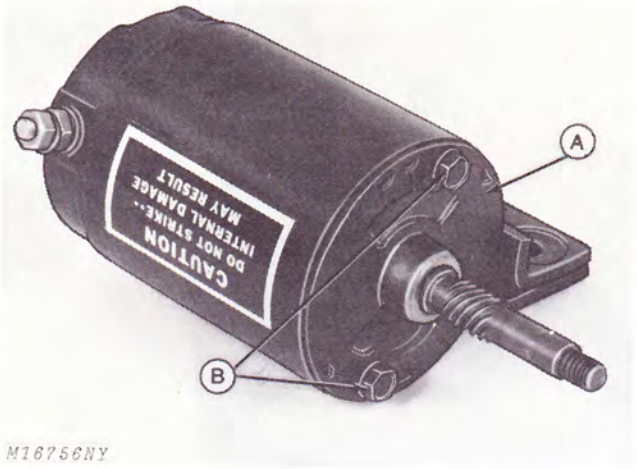


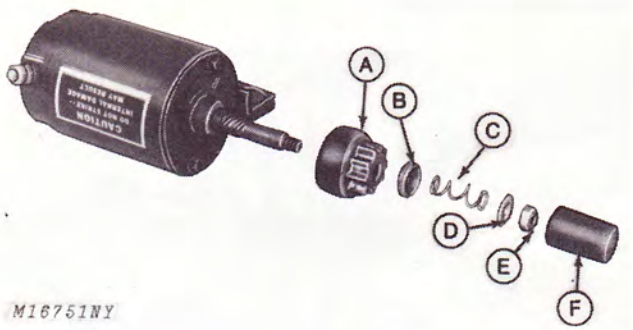
A—Drive End Cap **B—Thru Bolts**

Fig. 24-Assembling Drive End Cap

Install drive cap (A), Fig. 24, onto armature.

NOTE: The starter housing has a mark and an indentation on the inside which must fit into the two indentures on the drive end cap.

Insert thru bolts, (B), Fig. 24, and tighten to 20 to 25 in-lbs (2.25 to 2.82 Nm) torque.



A—Drive Gear
B—Gear Stop Spacer
C—Spring
D—Dust Cover Spacer
E—Stop Nut
F—Dust Cover

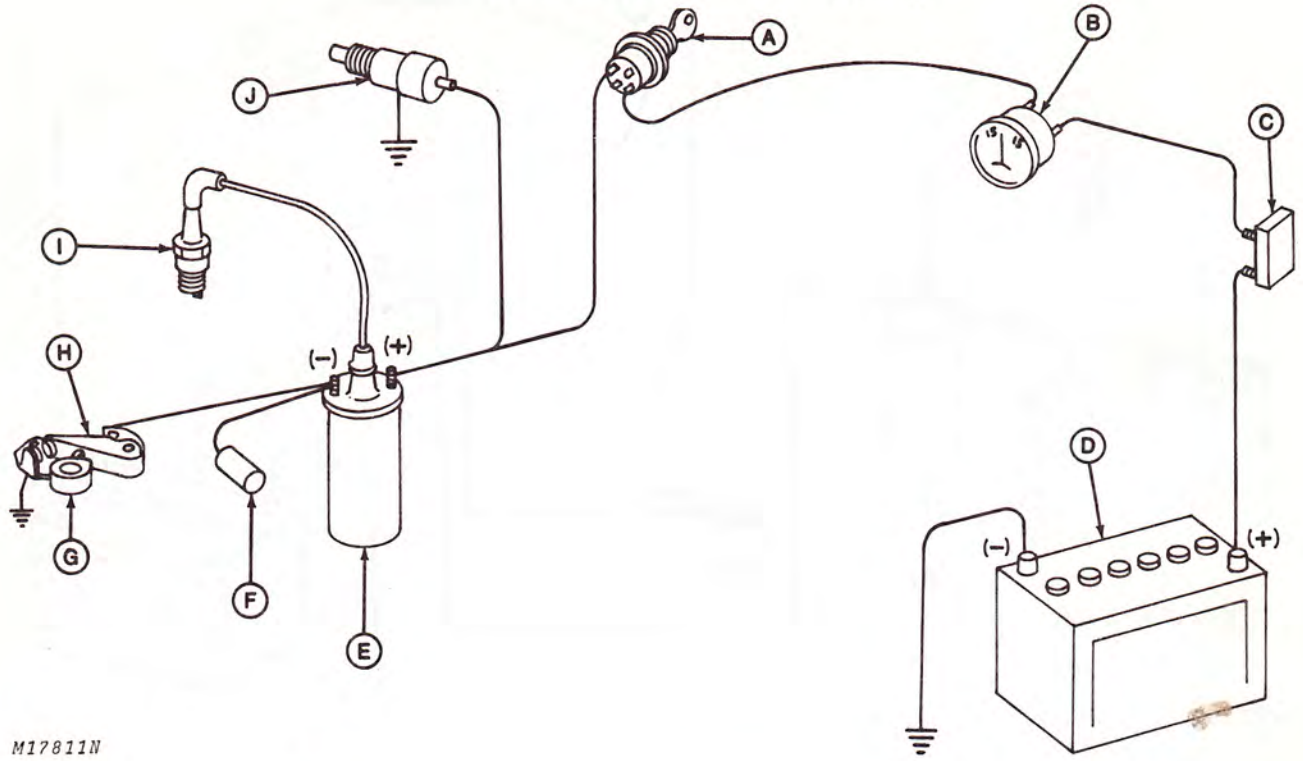
Fig. 25-Assembling Starter Drive

Lubricate armature shaft splines with a light coat of oil. Install drive assembly components as shown, Fig. 25. Tighten stop nut (E) to 45 to 50 in-lbs (5.1 to 5.6 Nm) torque.

Install starter on engine.

Group 15
IGNITION SYSTEM

PRINCIPLE OF OPERATION
300 Tractor (Serial No. -70,000)



M17811N

A—Ignition Switch
B—Ammeter
C—Circuit Breaker
D—Battery
E—Coil
F—Condenser
G—Cam
H—Breaker Points
I—Spark Plug
J—Anti-Dieseling Solenoid

Fig. 2-Ignition System Components

The K341AQS engine has a battery-coil ignition system.

With the ignition switch (A) closed, current flows from the battery (D) through the primary windings of the coil (E), and through the closed breaker points (H) to ground.

At the point when the piston is near top-dead-center (TDC) on the compression stroke, the breaker points (H) are opened by the cam (G) and push rod.

When the points are opened, the primary circuit is broken and the magnetic field within the coil collapses.

With the collapse of the primary field, the magnetic lines of force cut across the secondary coil windings and a high-voltage is induced. The high-voltage developed in the secondary coil causes the current to jump across the spark plug electrode gap, making a spark.

The residual current in the primary winding is absorbed by the condenser (F). This eliminates arcing at the points and aids in producing a stronger spark at the spark plug (I).

An anti-dieseling solenoid (J) is used to ensure the closing of the throttle during shut-down of the K341AQS engine. This prevents dieseling.

When the ignition switch (A) is closed, the solenoid is activated and the plunger on the solenoid extends outward, holding the throttle linkage at the proper position for idle speed. When the ignition switch is opened, the solenoid plunger retracts allowing the throttle to close completely. For adjustments, see page 30-10-5.

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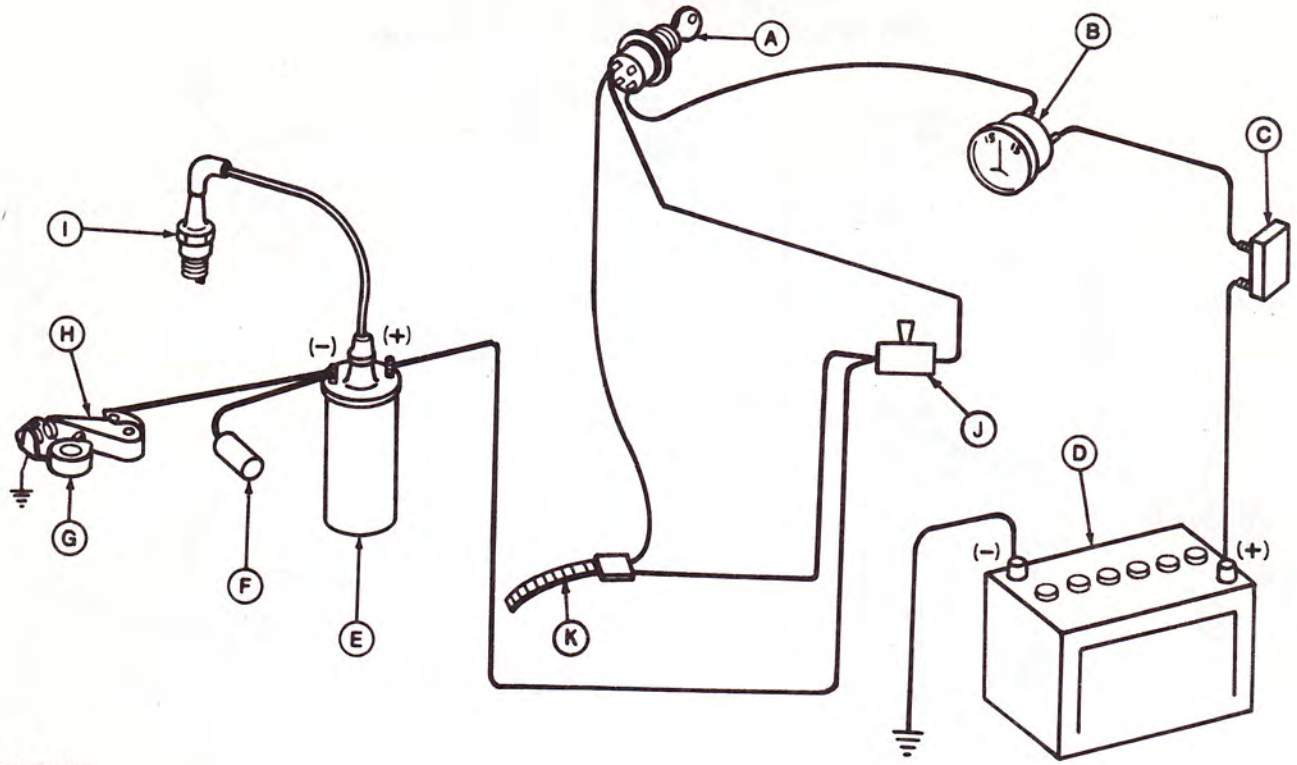
PRINCIPLE OF OPERATION
312 and 314 Tractor



M23235

A—Ignition Switch
B—Ammeter
C—Circuit Breaker
D—Battery
E—Coil
F—Condenser
G—Cam
H—Breaker Points
I —Spark Plug
J —PTO Switch
K—Seat Switch

Fig. 2-Ignition System Components

The K301AS and K321AQS engine has a battery-coil ignition system.

With the ignition switch (A) closed, current flows from the battery (D) through the primary windings of the coil (E), and through the closed breaker points (H) to ground.

At the point when the piston is near top-dead-center (TDC) on the compression stroke, the breaker points (H) are opened by the cam (G) and push rod.

When the points are opened, the primary circuit is broken and the magnetic field within the coil collapses.

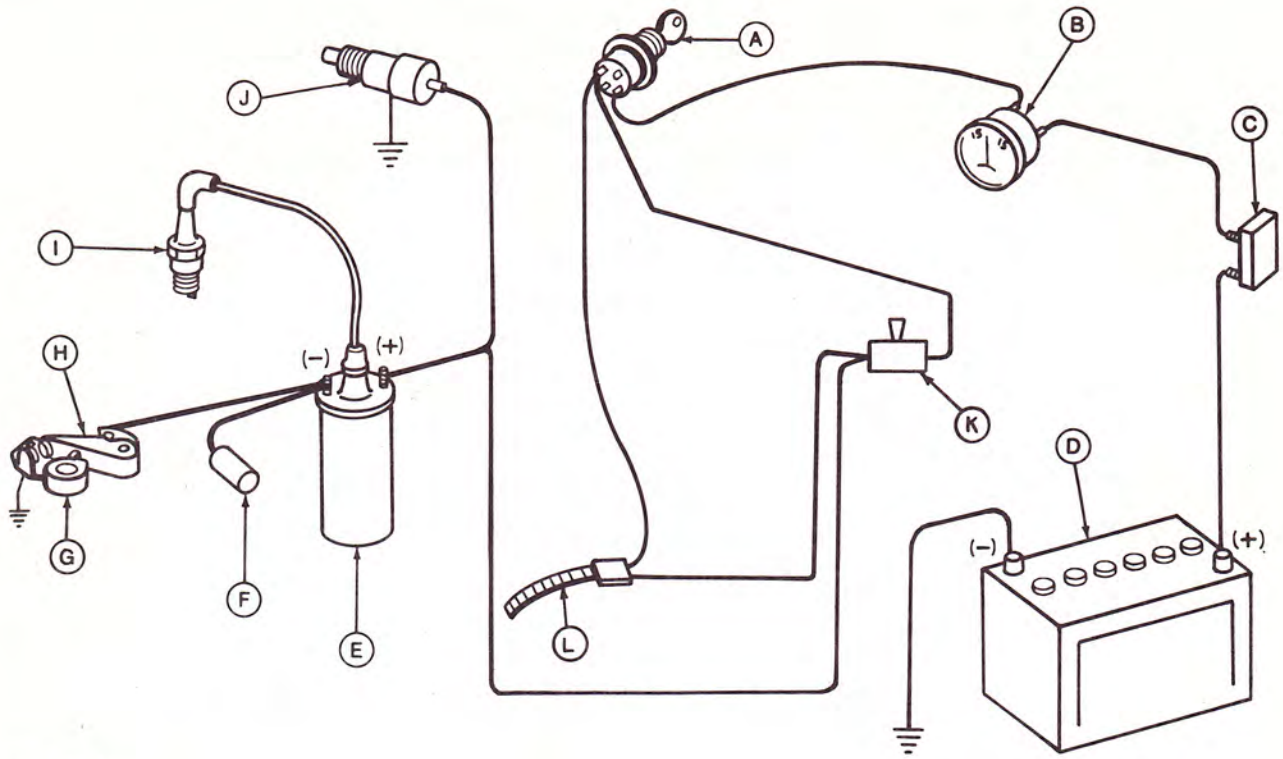
With the collapse of the primary field, the magnetic lines of force cut across the secondary coil windings and a high-voltage is induced. The high-voltage developed in the secondary coil causes the current to jump across the spark plug electrode gap, making a spark.

The residual current in the primary winding is absorbed by the condenser (F). This eliminates arcing at the points and aids in producing a stronger spark at the spark plug (I).

The PTO switch (J) and seat switch (K) work together to shut the engine off if the PTO is engaged without the operator being on the seat.

NOTE: Ammeter is not standard on 312, 314 (Serial No. -120,000).

PRINCIPLE OF OPERATION
300 Tractor (Serial No. 70,001-80,000) and 316 Tractor



M23236

A—Ignition Switch
B—Ammeter
C—Circuit Breaker
D—Battery
E—Coil
F—Condenser
G—Cam
H—Breaker Points
I —Spark Plug
J—Anti-Dieseling Solenoid
K—PTO Switch
L—Seat Switch

Fig. 3-Ignition System Components

The K341AQS engine has a battery-coil ignition system.

With the ignition switch (A) closed, current flows from the battery (D) through the primary windings of the coil (E), and through the closed breaker points (H) to ground.

At the point when the piston is near top-dead-center (TDC) on the compression stroke, the breaker points (H) are opened by the cam (G) and push rod.

When the points are opened, the primary circuit is broken and the magnetic field within the coil collapses.

With the collapse of the primary field, the magnetic lines of force cut across the secondary coil windings and a high-voltage is induced. The high-voltage developed in the secondary coil causes the current to jump across the spark plug electrode gap, making a spark.

The residual current in the primary winding is absorbed by the condenser (F). This eliminates arcing at the points and aids in producing a stronger spark at the spark plug (I).

An anti-dieseling solenoid (J) is used to ensure the closing of the throttle during shut-down of the K341AQS engine. This prevents dieseling.

When the ignition switch (A) is closed, the solenoid is activated and the plunger on the solenoid extends outward, holding the throttle linkage at the proper position for idle speed. When the ignition switch is opened, the solenoid plunger retracts allowing the throttle to close completely. For adjustments, see page 30-10-5.

The PTO switch (K) and seat switch (L) work together to shut off the engine if the PTO is engaged without the operator's weight on the seat.

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DIAGNOSING AND TESTING

Engine operating problems can be caused by many things, both mechanical and electrical. The chart below lists some of the engine problems that can be caused by a faulty ignition system. Once the cause of the problem has been isolated to the ignition circuit, follow the tests and adjustments in sequence. Detailed explanations of these test and adjustments can be found on the following pages. Many electrical system problems can be caused by more than one failing component or adjustment.

PROBLEM	TEST SEQUENCE			PAGE
1. Engine Will Not Start	A. Make a visual check of components, wiring and connections.			40-15-8
	B. Test ignition switch			40-15-8
	C. Test spark plug			40-15-8
	If No Spark:	**If Weak Spark:**	**Strong Spark:**	
	D. Test condenser	D. Test condenser	.....	40-15-8
	E. Test coil	E. Test coil	.....	40-15-9
	F. Check points	F. Check points	F. Check points	40-15-10
	G. Check timing	G. Check timing	G. Check timing	40-15-10
2. Engine Hard Starting	A. Make a visual check of components, wiring and connections			40-15-8
	C. Test spark plug			40-15-8
	If No Spark:	**If Weak Spark:**	**Strong Spark:**	
	D. Test condenser	D. Test condenser	.....	40-15-8
	E. Test coil	E. Test coil	.....	40-15-9
	F. Check points	F. Check points	F. Check points	40-15-10
	G. Check timing	G. Check timing	G. Check timing	40-15-10
3. Engine Misfires or Lacks Power	A. Make a visual check of components, wiring and connections			40-15-8
	C. Test spark plug			40-15-8
	F. Check points			40-15-10
	G. Check timing			40-15-10
	D. Test condenser			40-15-8
	E. Test coil			40-15-9

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PROBLEM	TEST SEQUENCE			PAGE
4. Engine Overheats Engine Knocks	A. Make a visual check of components, wiring and connections			40-15-8
	C. Test spark plug			40-15-8
	F. Check points			40-15-10
	G. Check timing			40-15-10
5. Engine Starts But Will Not Continue to Run	A. Make a visual check of components, wiring and connections			40-15-8
	B. Test ignition switch			40-15-8
	C. Test spark plug			40-15-8
	If No Spark:	**If Weak Spark:**	**Strong Spark:**	
	D. Test condenser	D. Test condenser	.....	40-15-8
	E. Test coil	E. Test coil	.....	40-15-9
	F. Check points	F. Check points	F. Check points	40-15-10
	G. Check timing	G. Check timing	G. Check timing	40-15-10
6. Engine Starts but Stops when PTO is Engaged	Make a visual check of PTO and seat switch wiring and connections			.....
	Test seat switch			40-15-12
7. Engine Will Not Start with PTO Disengaged Unless Seat Switch is Depressed	Make a visual check of PTO and seat switch wiring and connections			.....
	Test seat switch			40-15-12

Litho in U.S.A.

Ignition Switch

The ignition switch in the battery-coil ignition system routes the electrical current from the battery to the coil in both "START" and "RUN" positions. Since electrical current is needed to operate the ignition coil, a switch with a closed ignition circuit is required. This means that opening the circuit will stop the ignition function.

Spark Plug

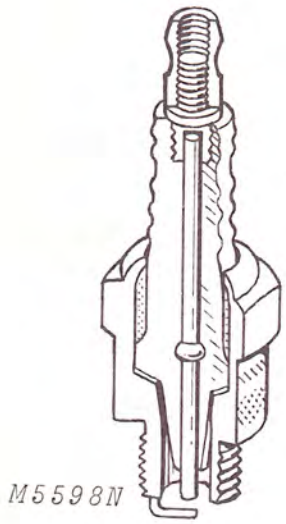


Fig. 4-Spark Plug

A spark plug, Fig. 4, consists mainly of two electrodes separated from each other by a specific gap. The side electrode is connected to the shell of the spark plug. The center electrode is completely insulated from the shell. The high-voltage produced in the secondary winding of the coil is applied to the center electrode and causes a spark to jump the gap to the side electrode. The spark, inside the cylinder, ignites the fuel-air mixture and starts the combustion process in the combustion chamber of the cylinder.

The gap spacing between electrodes is critical for efficient engine operation. Correct spark plug gap affects the entire range of performance of the engine; starting, idling, accelerating, power, and top speed.

Breaker Points

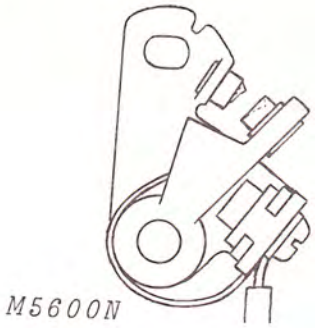


Fig. 5-Breaker Points

Engine operation is greatly affected by ignition timing and condition of the breaker points.

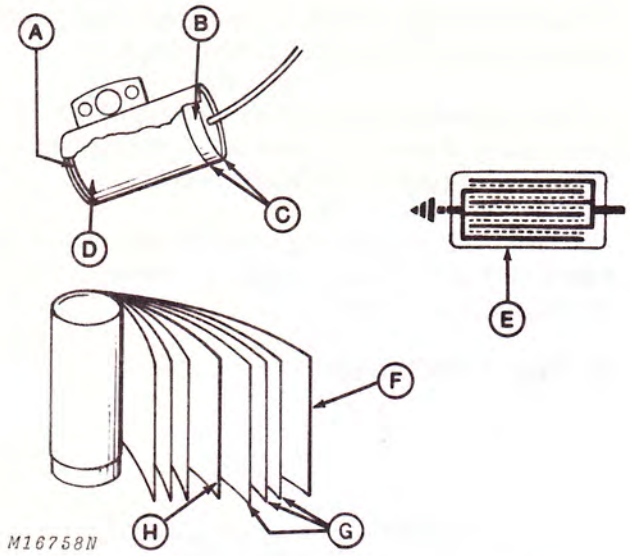
Ignition timing is affected by breaker point gap. Increasing the gap advances timing; decreasing the gap retards timing. Breaker point gap can vary from 0.018 to 0.022 in. (0.4572 to 0.5588 mm).

The points are opened by the breaker rod operated by a lobe on the camshaft. Unless the points are adjusted to specifications, weak, early or late sparking occurs. To achieve correct timing, see "Time Engine", page 40-15-10.

Replace badly burned or pitted breaker points. If points are oxidized, rub a piece of coarse cloth across surfaces. Clean dirty or oily points with cloth, but make sure no particles of lint are left between surfaces.

Litho in U.S.A.

Condenser

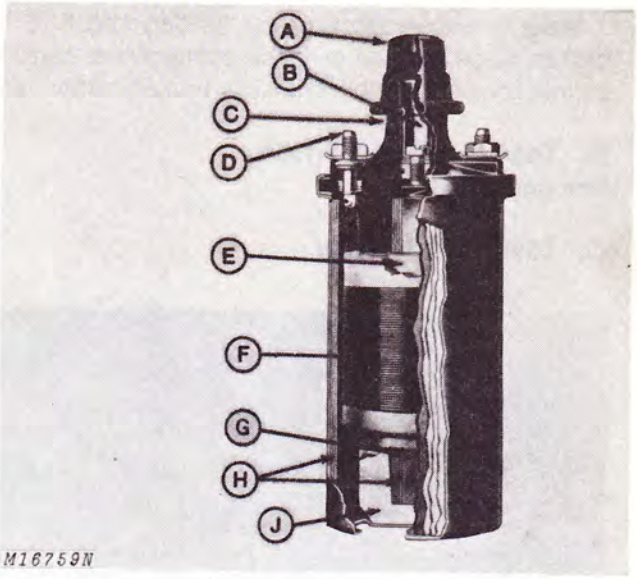


A—Spring
B—Gasket
C—Hermetically Sealed
D—Pressure Contact
E—Construction Section
F—Foil
G—Insulation
H—Foil

Fig. 6-Cutaway View of Condenser

When the magnetic field in the coil collapses, voltage much higher than the original voltage is induced into the primary winding. As the breaker points open, the current tends to continue flowing across the points. The resulting arc would damage the points in a short time. The condenser, by absorbing the surge of high-voltage, dampens the tendency of current to arc across the points. The condenser also allows the magnetic field to collapse rapidly which contributes to high-voltage induced into the secondary windings.

Coil



A—Sealing Nipple
B—High-Tension Terminal
C—Coil Cap
D—Primary Terminal
E—Secondary Winding
F—Primary Winding
G—Iron Core
H—Lamination
J—Porcelain Insulator

Fig. 7-Cutaway View of Coil

The ignition coil is a pulse transformer that steps up low voltage from the battery to the high-voltage necessary to ignite the fuel-air mixture at the spark plug gap.

The coil contains three basic parts: A primary winding (F) consisting of a few hundred turns of relatively heavy wire, a secondary winding (E) consisting of many thousand turns of very fine wire, and a laminated soft iron core (G) which serves to concentrate the magnetic field. These three units are placed in the coil case and immersed in oil. The coil cap (C) with its necessary attachment to the windings completes the entire coil.

When the primary circuit is energized (breaker points closed), a magnetic field is built up around both the primary and secondary coils. When the primary circuit is de-energized (breaker points open), the magnetic field collapses about the coils inducing a voltage within both of the coils. The voltage developed within the primary coil is absorbed and dissipated by the condenser. The voltage developed within the secondary coil (possible 25,000 volts or more) is distributed to the spark plug for igniting the fuel-air mixture within the cylinder.

A. Make a Visual Check of Components and Wiring

Make a visual check of the ignition circuit to find broken leads, broken or loose connections, corroded connections or possible cracks or broken components.

B. Test Ignition Switch

See page 40-10-8

C. Test Spark Plug

Fig. 8-Checking Spark at Plug

Remove ignition cable from spark plug and install adaptor, Fig. 8, or an ordinary paper clip. Hold adaptor approximately ⅛ inch (3.18 mm) away from spark plug terminal while cranking engine.

A weak spark or no spark indicates ignition system difficulties. Test further to isolate problem.

A sharp, snapping spark indicates coil, breaker points, and condenser are in good condition.

If there is no spark at the plug terminal, hold the high-tension lead at the steel base of the plug while cranking engine. If a spark jumps here, the plug is bad and should be cleaned or replaced.

NOTE: In Canada, compliance with audio interference regulations certified. Replace spark plug with resistor spark plug only.

IMPORTANT: Clean area around plug before removal to prevent dirt entering combustion chamber.

Remove, clean, inspect and regap spark plugs to 0.035 inch (0.8890 mm) every 100 hours. Bend only the outer electrode when setting gap.

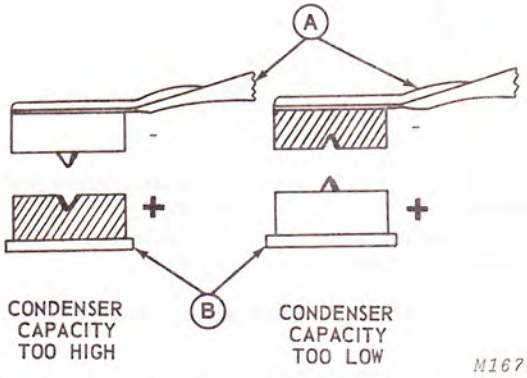
Do not sandblast, wire brush, scrape, or otherwise service a plug in poor condition. Install a new plug.

Use a spark plug wrench to remove and replace plug. Tighten plug to 27 ft-lbs (36.6 Nm) torque.

Good operating conditions are indicated if plug has a light coating of gray or tan deposit. A dead white, blistered coating could indicate overheating.

A black (carbon) coating may indicate an over-rich fuel mixture caused by a clogged air cleaner or improper carburetor adjustment.

D. Test Condenser



A—Movable Contact **B—Stationary Contact**

Fig. 9-Breaker Point Build-Up

If badly burned breaker points occur frequently, the condenser should be suspected. If condenser capacity is too low, metal will transfer from the stationary contact (B) to the movable contact (A), as illustrated in the left-hand half of Fig. 9. If capacity is too high, the metal will build up on stationary contact (B), right-hand half of Fig. 9.

Inspect the condenser for visible damage. Look for damaged terminal lead, dents in the case or a broken mounting clip.

Condensers can be tested off the tractor on test units as shown in Fig. 10 (page 40-15-9). Follow manufacturer's recommendations to make the following condenser tests:

1. Capacity
2. Leakage
3. Short
4. Series resistance

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Testing Condenser—Continued

Fig. 10-Testing Condenser Capacity

If inspection or tests disclose a defective condenser, replace condenser. Install a new condenser whenever condition of points indicate need.

E. Test Coil

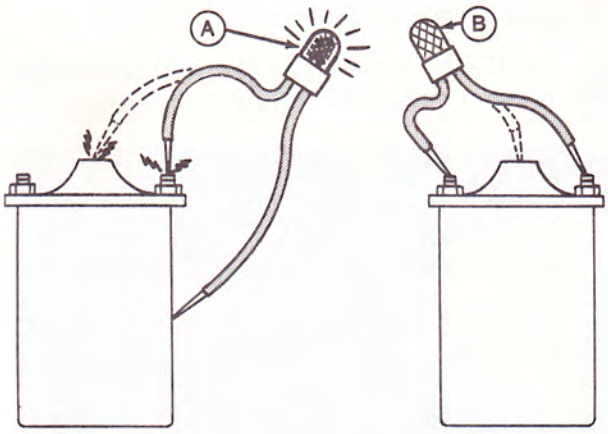
Fig. 11-Testing Coil Power

When coil failure is suspected, use an analyzer, Fig. 11 to test coil.

Follow manufacturer's recommendations to test the following.

1. Coil power test.
2. Coil high-speed test.
3. Coil surface insulation test.
4. Coil continuity test.
5. Primary resistance test.
6. Coil ground test.

Testing Coil for Grounded Windings



A—Lamp Lights = Grounded Winding
B—Lamp Does Not Light = Open Winding

Fig. 12-Testing Coil for Grounded or Open Windings

To test the windings, use a test lamp and probes, Fig. 12.

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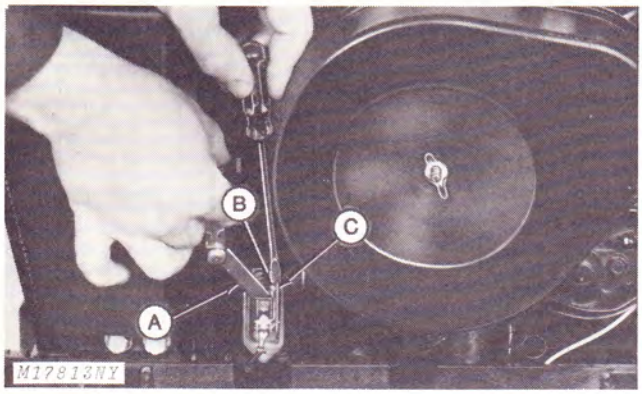
ADJUSTMENTS

F. Adjust Breaker Points

⚠ CAUTION: Disconnect spark plug cable to prevent engine starting accidentally.



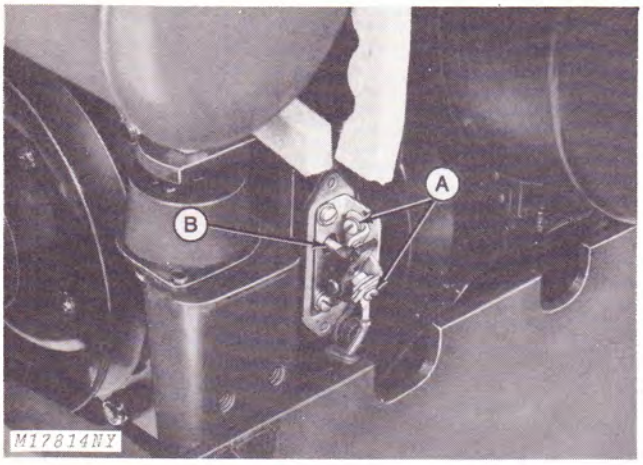
A—Feeler Gauge **B—Locking Screw** **C—V-Slot**

Fig. 13-Adjusting Breaker Points

Remove ignition point cover and rotate engine flywheel until points are fully opened.

Check point gap with a 0.020-inch feeler gauge (A). If adjustment is required, loosen locking screw (B) and move screwdriver in V-slot (C) until points are properly set. After tightening locking screw (B), recheck point gap.

Engine operation is greatly affected by breaker point condition and adjustment. If points are burned or badly oxidized, little or no current will pass. As a result, the engine may not operate at all or may miss particularly at full throttle.



A—Breaker Point Attaching Screws **B—Push Rod**

Fig. 14-Replacing Breaker Points

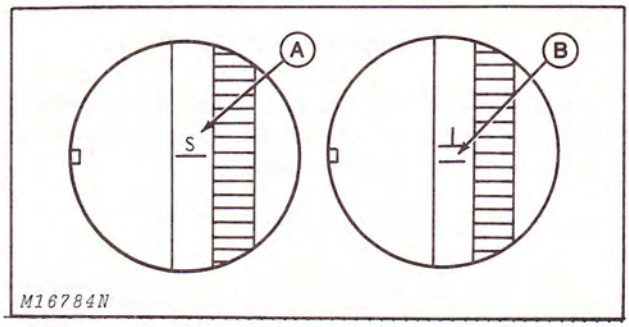
To replace points, remove point cover; then remove attaching screws (A), Fig. 14.

Check condition of breaker point push rod (B). An excessively tight push rod can hang-up and cause ignition failure, particularly with a hot engine.

Install new points. Replace cover, being certain rubber grommet and cover gasket are in position and in good condition.

G. Time Engine

The engine is equipped with a timing sight hole in the blower housing.



A—Spark Point **B—Top-Dead-Center**

Fig. 15-Timing Marks and Indicator

Two timing marks are stamped on the flywheel, Fig. 15. The "T" mark (B) indicates top-dead-center (TDC) while the "S" mark (A) indicates the spark point, which is 20 degrees before TDC.

Two methods are used for timing - the static and timing light methods. See page 40-15-11 for details.

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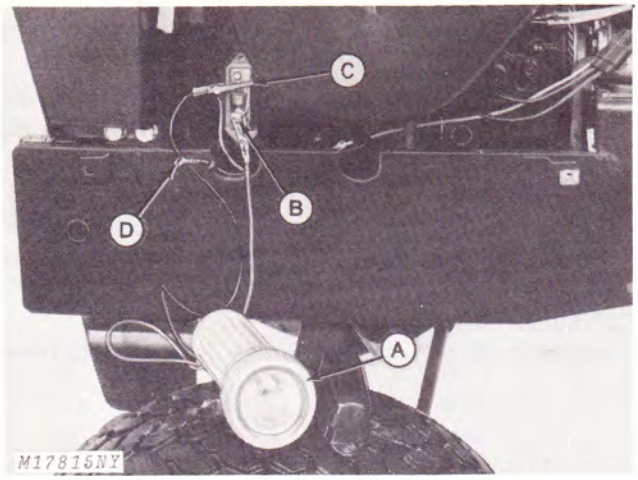
Static Timing Method



A—Flashlight Tester **C—Ground**
B—Lead Screw **D—Breaker Point Lead**

Fig. 16-Static Timing

Connect an ohmmeter or flashlight tester (A) to breaker point lead screw (B) and to ground (C), Fig. 16. Breaker point lead (D) must be disconnected from points.

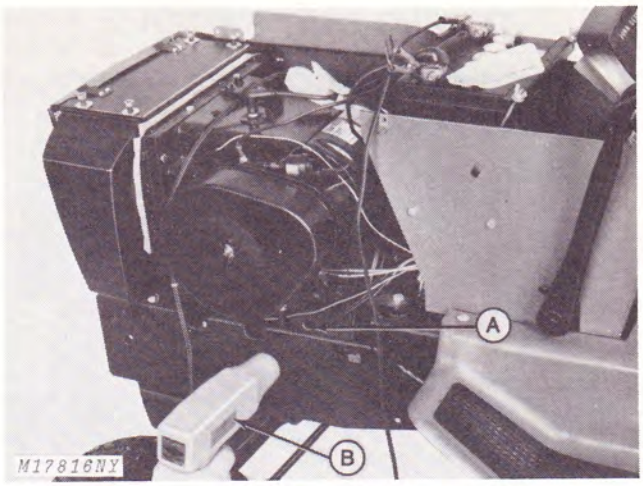
Rotate engine normally, until test light goes out, indicating points are just starting to open. At this time, the "S" mark on flywheel should be in alignment with the mark on the flywheel shrouding as shown in Fig. 16. If necessary, adjust gap slightly to obtain this condition.

Timing Light Method

Several different types of timing lights are available. Follow manufacturer's instructions for type used. The following timing procedure can be used with most timing lights.

Attach the induction pick-up to the high-tension lead at spark plug.

Connect one timing light lead to this adapter. Connect second timing light lead to positive side of battery. See timing light instructions for battery size, wiring, etc. Connect third timing light lead to ground.



A—Sight Hole **B—Timing Light**

Fig. 17-Timing With Light—
300 Tractor Illustrated

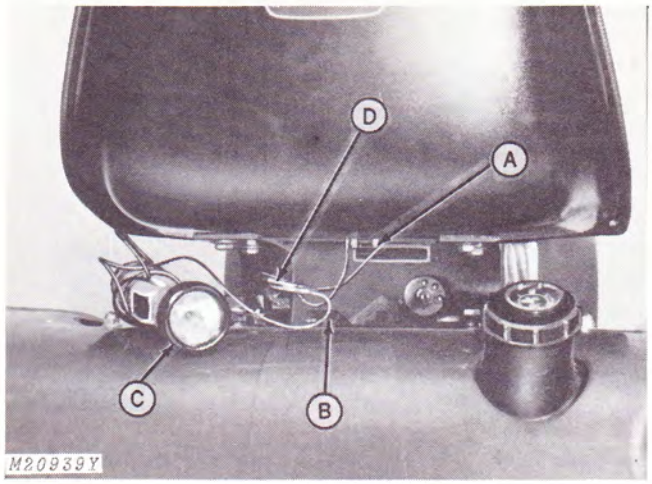
Rotate engine by hand until "S" mark is visible through sight hole (A), Fig. 17. Chalk "S" line for easy reading.

Run engine at 2000 to 2200 rpm. Aim timing light (B), Fig. 17, into sight hole (A). The light should flash just as "S" mark is in alignment with mark on flywheel housing inside sight hole as shown, Fig. 15, page 40-15-10.

If timing is off, adjust breaker point gap slightly to correct.

Litho in U.S.A.

TESTING SEAT SWITCH



A—Switch
B—Coupler
C—Test Light
D—Switch Terminals

Fig. 18-Testing Seat Switch

To test the seat switch (A), disconnect coupler (B) and attach a test light (C) to the switch terminals (D). Place hand in center of seat cushion and press down. The test light should light. If the light fails to light, remove the seat and replace the switch.

TESTING PTO SWITCH IGNITION CIRCUIT

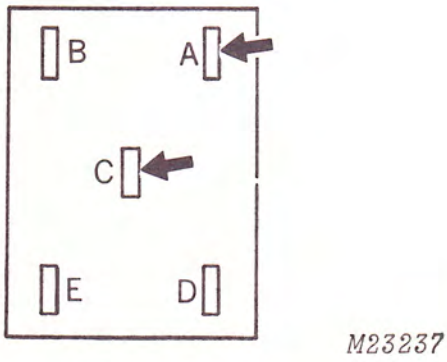


Fig. 19-Testing PTO Switch Ignition Circuit

To test the PTO switch ignition circuit, remove the three-terminal connector, attach a test light to terminals shown Fig. 19, and move toggle to "OFF" position. Test light should light. Move toggle to "ON" position and test light should go out. If not, replace the switch.

SPECIFICATIONS

Spark Plug Gap ..... 0.035 in. (0.8890 mm)

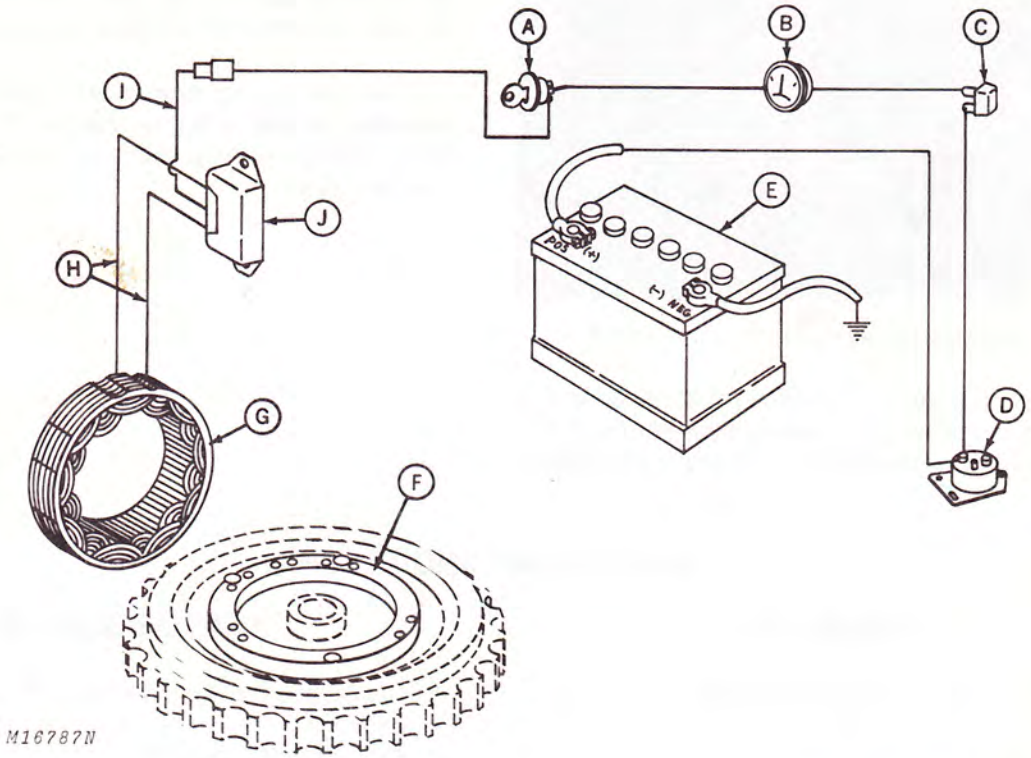
Breaker Point Gap ..... 0.018 to 0.022 in. (0.4572 to 0.5588 mm)

Coil Resistance
- Primary Windings ..... 2 to 3 ohms
- Secondary Windings .....8,000 to 10,000 ohms

Condenser
- Capacity-Microfarads ..... 0.18 to 0.23 mfds

Group 20
CHARGING SYSTEM

PRINCIPLE OF OPERATION



A—Key Switch
B—Ammeter (300 and 316 Tractor)
C—Circuit Breaker
D—Solenoid
E—Battery
F—Magnetic Flywheel Ring
J—Rectifier-Regulator
G—Alternator-Stator
H—AC Leads
I—B+Lead

Fig. 1-Charging System Components

Alternator

NOTE: 312 and 314 Tractors below Serial No. 120,001 are not equipped with an ammeter (B), Fig. 1, as regular equipment.

A 15-amp alternator supplies electrical energy to charge the 12-volt battery. The battery, in turn, furnishes energy for cranking, ignition and accessories.

The alternator features a magnetic ring (F), permanently affixed to the inside rim of the flywheel, an alternator-stator assembly (G) bolted to the engine bearing plate, and a rectifier-regulator (J), connected to it and mounted to the engine.

The magnetic ring (F) on the flywheel is made of a brittle ceramic material. Care should be used when handling the flywheel to prevent damage to the magnets.

The magnetic ring rotates around the stator, generating an alternating current in the stator windings. This alternating current is routed to the rectifier-regulator where it is converted to direct current (DC). Direct current conversion is required because the polarity of the battery will not accept alternating current.

The rectifier-regulator also controls the rate of charge to the battery, depending on battery requirements.

With this system, the battery and alternator work hand-in-hand to supply the needs of the engine and accessories, each one being dependent upon the other.

Litho in U.S.A.

Rectifier-Regulator

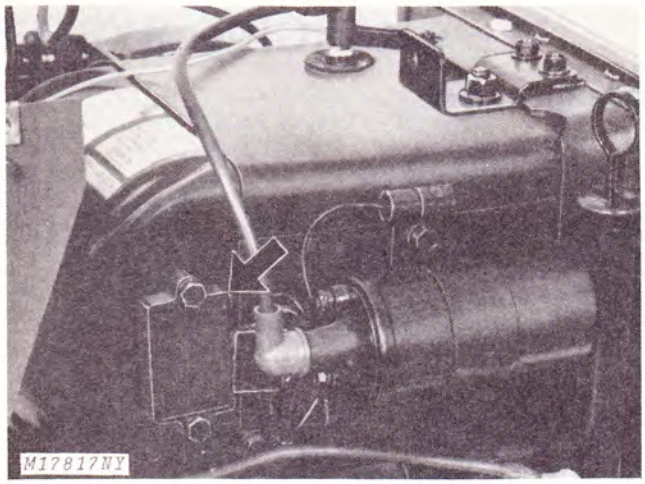


Fig. 2-Rectifier-Regulator — 300 Tractor Illustrated

The alternating current produced in the alternator is changed to direct current in the rectifier-regulator, Fig. 2. Direct current is necessary for charging the battery.

This change is accomplished through the use of solid-state electronic devices which are arranged to form a half-wave bridge rectifier.

Regulation is also provided by electronic devices (Zener Diodes) which "sense" the counter-voltage created by the battery to control or limit the charging rate. Since these devices generate heat in operation, the regulator is finned on the back side to provide cooling.

When the battery is in a low state of charge, the regulator permits a higher charge rate to the battery. When battery is fully charged, the devices limit the charging rate.

DIAGNOSING AND TESTING

PROBLEM	TEST SEQUENCE
1. Battery remains low or discharged.	A. Clean battery, test battery and check all connections. B. Test rectifier-regulator. C. Test alternator-stator. D. Check circuit breaker.
2. Battery uses too much water or battery is spewing electrolyte.	A. Test battery and check all connections. B. Test rectifier-regulator.
3. No DC output from rectifier-regulator.	A. Check all connections. B. Test rectifier-regulator. C. Test alternator-stator. D. Check circuit breaker.
4. Unsteady or low alternator output.	A. Check all connections. C. Test alternator-stator.
5. No AC output from alternator.	A. Check all connections. C. Test alternator-stator.

The above tests A through D can be found on the following pages.

Litho in U.S.A.

CHARGING SYSTEM TESTS

A. Test battery and check all connections. See page 40-10-6 for battery tests.

Fig. 3-Poor Connections

A visual inspection will often reveal much useful information about the charging system. Poor connections between the regulator and battery, or poor ground connections between the battery to engine and engine-to-frame will cause unwanted resistance.

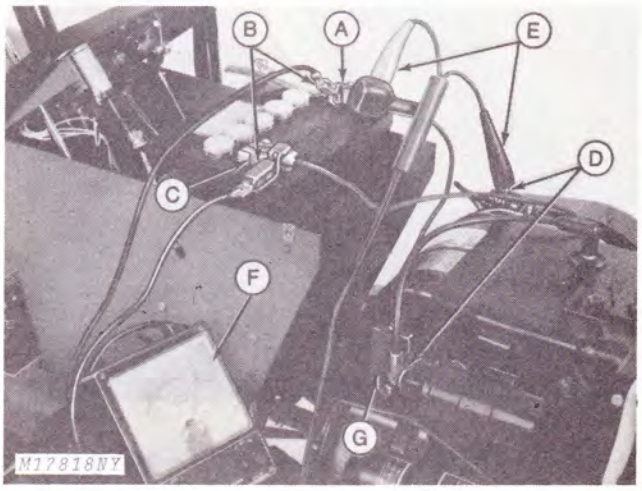
Unwanted resistance in the circuit results in unwanted voltage losses. An excessive voltage loss in the charging circuit tends to keep the battery in an undercharged condition.

B. Test Rectifier-Regulator

NOTE: Battery discharge may be caused by corrosion across the top fo the battery, rather than a faulty rectifier-regulator.

To test the rectifier-regulator (G), Fig. 4, connect the voltmeter leads (B) from a DC volt-ammeter (F) across the battery terminals. At the same time connect an ammeter lead (E) between the B+ lead (D) from the rectifier-regulator (G) and the positive battery terminal (A), Fig. 4. The B+ lead can be removed from the coupler at the left side of the engine. The battery must be in a partially discharged condition.

NOTE: The battery must be in a partially discharged condition.



M17818NY

A—Positive Battery Terminal
B—Voltmeter Leads
C—Negative Battery Terminal
D—B+ Lead
E—Ammeter Lead
F—Volt-Ammeter (Dual Meter)
G—Rectifier-Regulator

Fig. 4-Testing Rectifier-Regulator

Run the engine at full throttle (3500 rpm).

The volt-ammeter (F) should show approximately a 15 amp output until the battery reaches a charge of 13.8 to 14.7 volts. At this time amp output should begin to drop off.

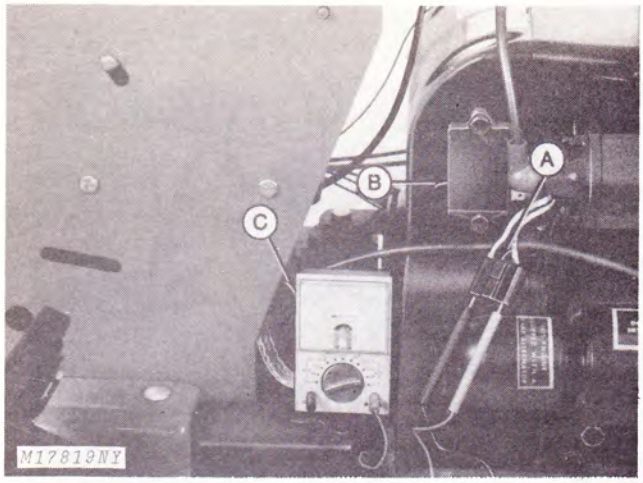
If amp output does not drop off and battery voltage goes beyond 15 volts, the rectifier-regulator is defective because it is allowing an overcharge.

If, however, the ammeter reading indicates a 15 amp output, but the battery voltage will not come up to 13.8 volts, the battery or connections are defective.

If the ammeter reading indicates less than 15 amp output before the battery reaches 13.8 volts, either the rectifier-regulator or the alternator-stator is defective. Test the alternator-stator to determine if either or both are defective.

Litho in U.S.A.

C. Test Alternator-Stator



M17819NY

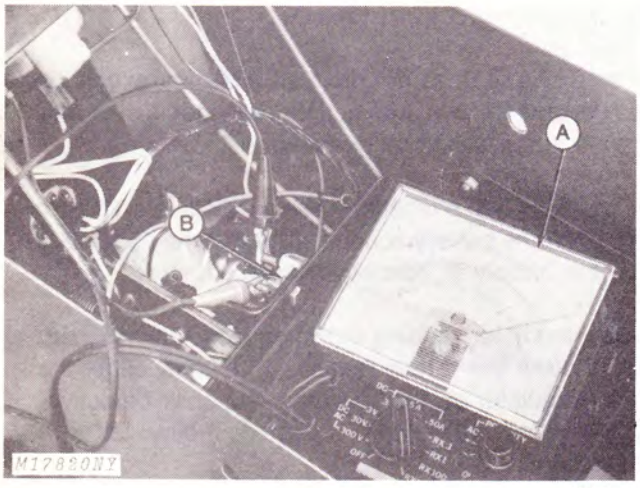
A—Coupler **B—Rectifier-Regulator** **C—AC Voltmeter**

Fig. 5-Testing Alternator-Stator

To test the alternator-stator, unplug the coupler (A) at the rectifier-regulator (B). Connect an AC voltmeter (C) across the AC terminals in the coupler as shown in Fig. 5.

Run the engine at full throttle. Voltage reading should be at least 28 volts. If less than 28 volts, alternator-stator is defective.

D. Test Circuit Breaker



M17820NY

A—Ohmmeter **B—Circuit Breaker**

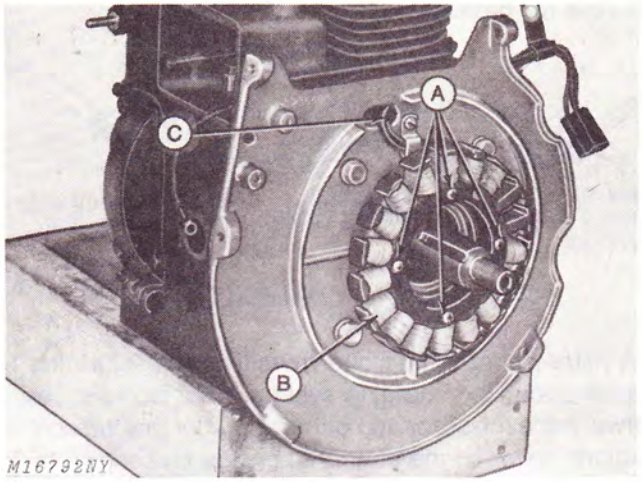
Fig. 6-Testing Circuit Breaker

To test for a defective circuit breaker (B), use an ohmmeter (A), Fig. 6 or continuity test light. If an ohmmeter is used, a good circuit breaker will show zero resistance. A continuity test light will light.

Litho in U.S.A.

REPAIR

Replacing Alternator-Stator



M16792NY

A—Screws **B—Stator** **C—Wires**

Fig. 7-Removing Alternator-Stator

If AC voltage test proved alternator-stator defective, replace it as follows:

Remove blower housing and flywheel.

Disconnect stator wires (C) from clip and 3-terminal coupler, Fig. 7. Remove four screws (A) securing stator (B) to bearing plate and remove stator.

Reverse above procedure for installation.

Group 25
LIGHTS AND HOURMETER

Lights (All 300 and 316 Tractors and 314 Tractors (Serial No. 120,001-)

All 300 and 316 Tractors and 314 Tractors Serial No. 120,001 and above are equipped with lights as standard equipment. There are three headlights with a uniquely designed lens built into the hood. Models 300 and 316 Tractors only, are equipped with taillights. The taillights are located on the rear of the fender-deck. Bulbs can be quickly replaced without removing the lenses.

NOTE: A headlight kit is available for all 312 and early Model 314 Tractors.

Troubleshooting

Following are some common causes of problems in the lighting circuit. If the lighting circuit fails, a visual inspection of connections, wiring harness, sockets and bulbs will usually detect the problem.

DIAGNOSING MALFUNCTIONS

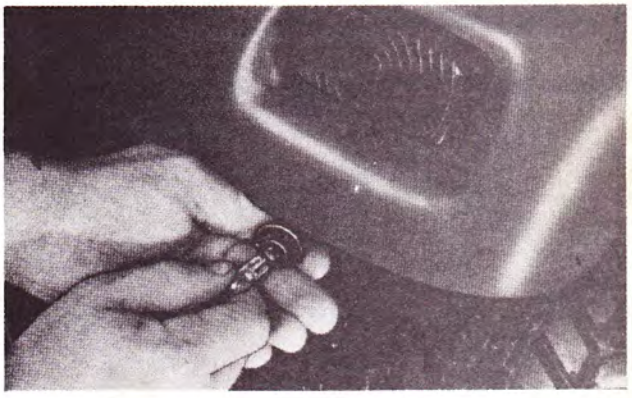
Problem	Cause
Dim Lights	High resistance in circuit, or poor ground on lights. Low battery charge. Defective light switch or ignition switch.
Lights Burn Out Prematurely	Excessive voltage due to faulty regulator or ground wire on alternator. Wrong type bulb being used.
Light Fails to Work	Defective socket or bulb. Broken wire or disconnected coupler. Corroded connections. Switch failure.

Removal

M17822NY

Fig. 1-Removing Headlight Bulb on 300 and 316 Tractors

To remove headlights, turn the light socket ⅛ turn to the left, then remove bulb from socket by pushing down on the bulb and turning ¼ turn to the left.



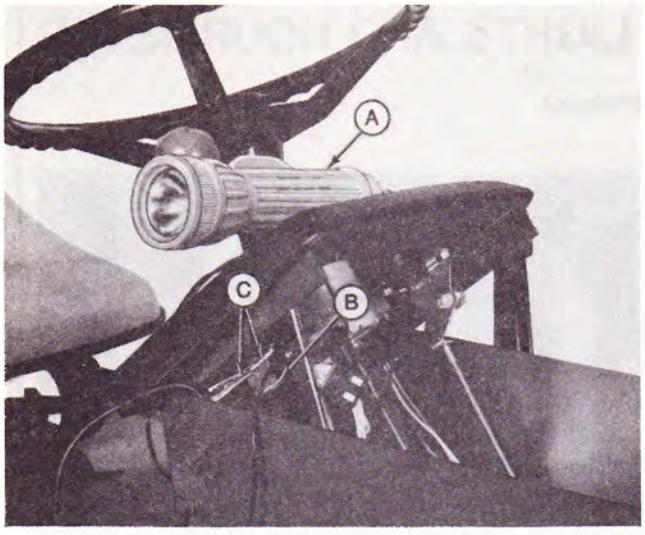
M16794NY

Fig. 2-Removing Taillight on 300 and 316 Tractors

To remove the taillights, turn light socket ¼ turn toward the right side of the tractor. Remove the bulb from the socket by pulling straight out.

Litho in U.S.A.

Testing Light Switch



M17827NY

A—Test Light **B—Light Switch** **C—Switch Terminals**

Fig. 3-Testing Light Switch on 300 and 316 Tractors

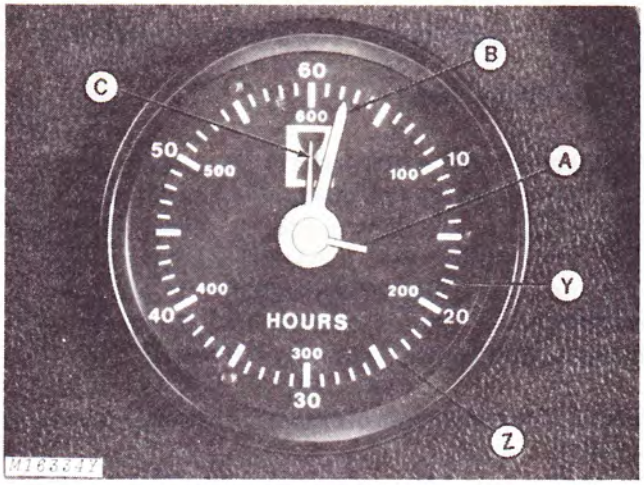
To test the light switch (B, Fig. 3), use a test light (A), and connect it to the switch terminals (C).

With the switch (B) on the "ON" position, the test light (A) will glow. With the switch (B) in the "OFF" position, the test light (A) should go out.

To test the ignition switch, see page 40-10-8.

To test the PTO Clutch switch, see page 40-10-9.

Hourmeter 300 Tractor (Serial No. 30,001-55,000)



M16334Y

A—Second Needle **C—Hundred Hour Needle**
B—Ten Hour Needle

Fig. 4-Hourmeter on 300 Tractor (Serial No. 30,001-55,000)

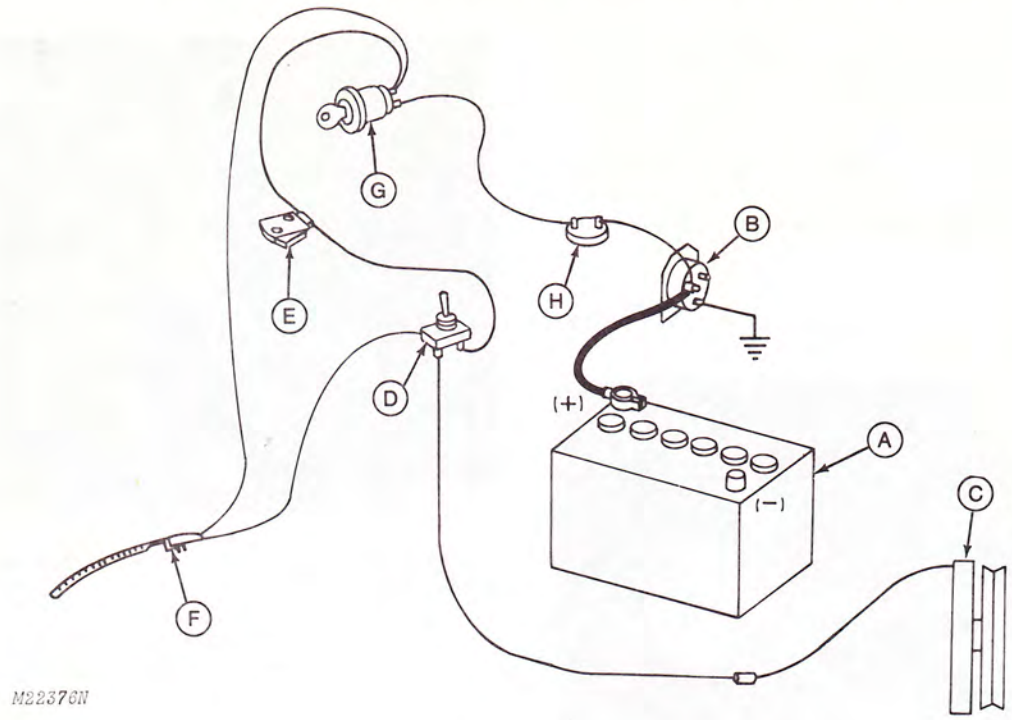
The hourmeter on the 300 Tractor (Serial No. 30,001-55,000) has three needles. It will operate only when the ignition switch is in the on position. The smallest needle (A) records time in seconds. (This also indicates the hourmeter is working.) The largest needle (B) is read with the outside numbers ten through sixty. This records hours of operating time from one to sixty hours. The smaller needle (C) is used with the inside numbers 100 through 600. This records operating time from 10 to 600 hours.

Example: If needle"B" is pointing to "Y" on the dial, the correct reading would be 18 hours. If needle "C" is pointing to "Z" on the dial, the correct reading would be 240 hours.

NOTE: 300 Tractors Serial No. 55,001-80,000, and 312, 314 and 316 Tractors may be equipped with a digital-type hourmeter as extra equipment.

Litho in U.S.A.

PTO Clutch and Switch—312 and 314 Tractors



A—Battery **C—PTO Clutch** **E—PTO Neutral-Start Switch** **G—Ignition Switch**
B—Solenoid **D—PTO Switch** **F—Seat Safety-Start Switch** **H—Circuit Breaker**

Fig. 3-Accessory Circuits

The PTO clutch (C) is activated with a PTO switch (D) located at the dash panel. The PTO switch also acts as a neutral-start switch that directs current from the solenoid terminal of the ignition switch (G) to the solenoid (B) when the PTO switch is in the "OFF" position.

When the PTO switch (D) is in the "ON" position, current is directed to the PTO clutch (C) activating the electro-magnet engaging the clutch.

NOTE: The tractor is equipped with a seat safety-start switch (F). The switch shuts off the engine whenever the operator leaves the seat with the engine running and the PTO engaged.

Lights (All 300 and 316 Tractors and 314 Tractors Serial No. 120,001 and Above)

All 300 and 316 Tractors and 314 Tractors Serial No. 120,001 and above are equipped with lights as standard equipment. There are three headlights with a uniquely designed lens built into the hood. Models 300 and 316 Tractors only, are equipped with taillights. The taillights are located on the rear of the fender-deck. Bulbs can be quickly replaced without removing the lenses.

NOTE: A headlight kit is available for all 312 and early Model 314 Tractors.

Fig. 4-Removing Headlight Bulb on 300 and 316 Tractors

To remove headlights, turn the light socket 1/8-turn to the left, then remove bulb from socket by pushing down on the bulb and turning 1/4-turn to the left.

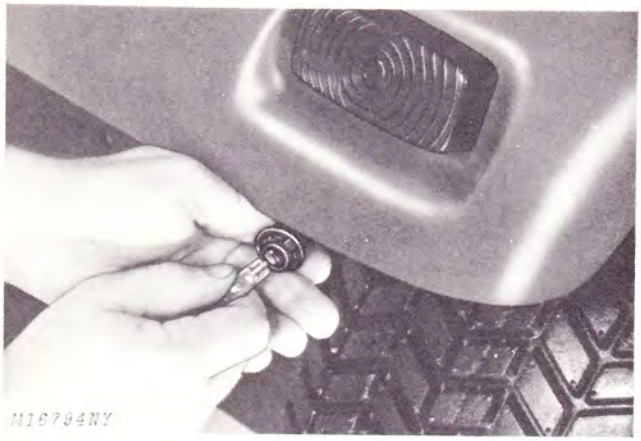
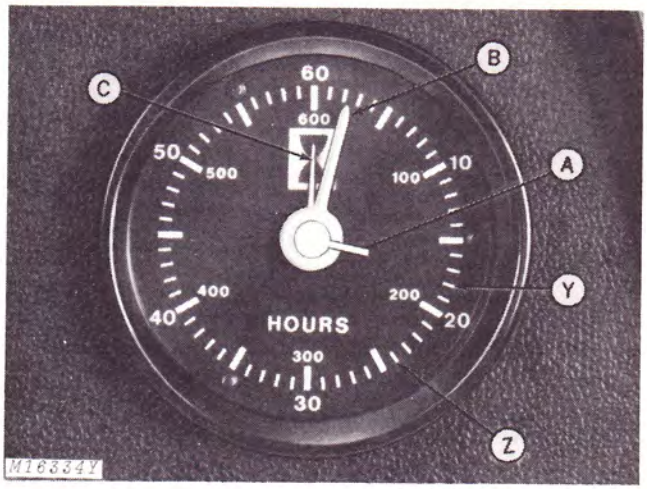


Fig. 5-Removing Taillight on 300 and 316 Tractors

To remove the taillights, turn light socket 1/4-turn toward the right side of the tractor. Remove the bulb from the socket by pulling straight out.

Hourmeter (300 Tractor Serial No. 30,001-55,000)



A—Second Needle
B—Ten Hour Needle
C—Hundred Hour Needle

Fig. 6-Hourmeter on 300 Tractor (Serial No. 30,001-55,000)

The hourmeter on the 300 Tractor (Serial No. 30,001-55,000) has three needles. It will operate only when the ignition switch is in the on position. The smallest needle (A) records time in seconds. (This also indicates the hourmeter is working.) The largest needle (B) is read with the outside numbers ten through sixty. This records hours of operating time from one to sixty hours. The smaller needle (C) is used with the inside numbers 100 through 600. This records operating time from 10 to 600 hours.

Example: If needle "B" is pointing to "Y" on the dial, the correct reading would be 18 hours. If needle "C" is pointing to "Z" on the dial, the correct reading would be 240 hours.

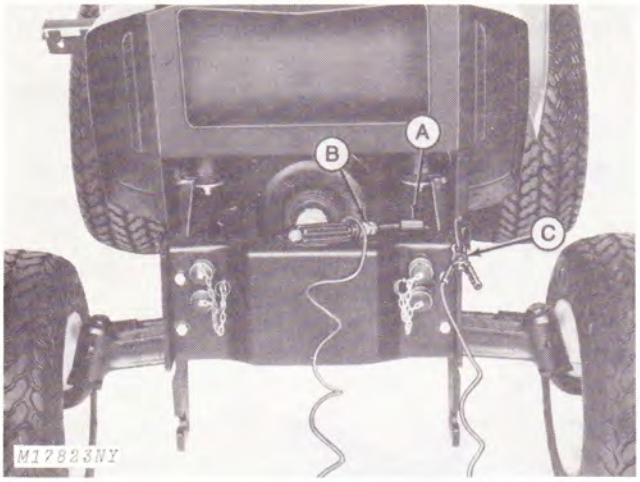
NOTE: 300 Tractors Serial No. 55,001-80,000, and 312, 314 and 316 Tractors may be equipped with a digital-type hourmeter as extra equipment.

TESTING

PTO Clutch

A faulty clutch switch, loose wiring or short circuit can appear as clutch failure.

Always make a visual check of all connections, wires and components because they can be a possible cause of clutch failure.



A—Coupler **B—Test Light** **C—Ground Wire**

Fig. 7-Testing PTO Clutch

To test the PTO clutch, disconnect the coupler (A), Fig. 7, at the field coil. Insert a 12-volt test light (B) into the coupler (A), Fig. 7, leading from the PTO switch. Ground the other test light wire (C) to the tractor frame. Turn the key switch to the "RUN" position, and place the PTO switch in the "ON" position.

If the test light lights, the PTO is defective, the connection between the wire from the switch and field coil wire was poor or adjustment is needed.

Check the wire where it enters the field coil to see that the pulley and rotor do not rub on the wire.

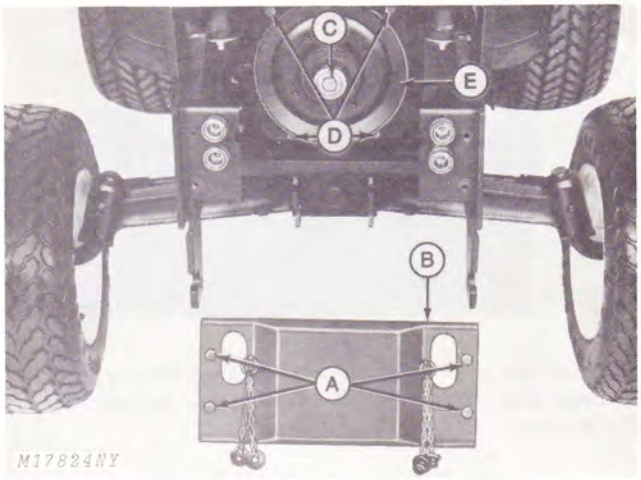
To adjust the PTO clutch, remove the spark plug wire and engage the PTO clutch.

Push down on the braking plate (F, Fig. 8) and tighten adjusting nuts (D) until there is no clearance between the nuts and plate when the plate is depressed.

Back out each nut (D) until there is 0.012 to 0.014-inch (3.048 to 3.556 mm) clearance between each nut and the braking plate (F).

Check clearance with a feeler gauge.

After checking PTO clutch adjustment, start the engine and move the PTO switch to the "ON" position. If the clutch still does not engage, remove the clutch for inspection and test the field coil.

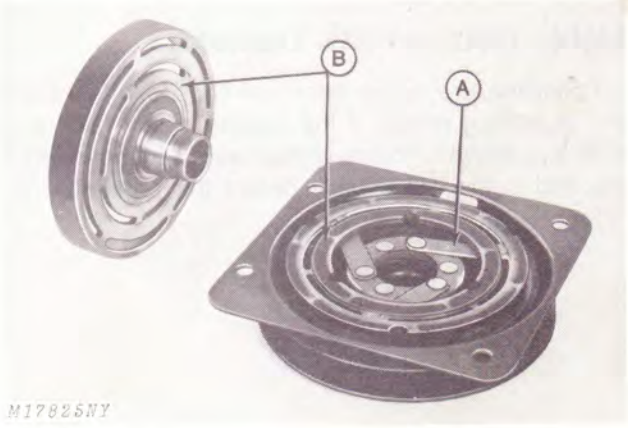


A—Cap Screws **D—Adjusting Nuts**
B—Front Bumper **E—Pulley and Rotor**
C—Large Cap Screw **F—Braking Plate**

Fig. 8-Removing PTO Clutch with Rotor and Pulley

To remove PTO clutch, remove four cap screws (A) from the front bumper (B) and remove the bumper.

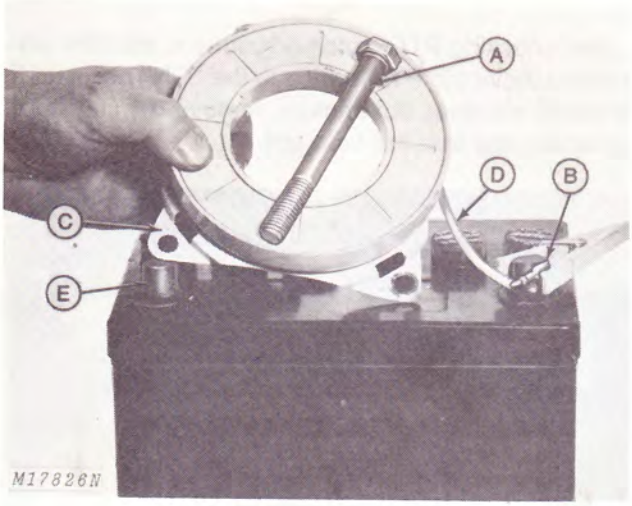
Remove the large cap screw (C) from the PTO clutch. Remove the four adjusting nuts (D) from the PTO and slide the pulley and rotor (E) from the crankshaft. Remove the key carefully. Do not lose the key.



A—Contact Springs **B—Rotor and Contact**

Fig. 9-PTO Inspection

After the rotor and pulley have been removed, inspect for weak or broken contact springs (A), Fig. 9, or paint between rotor and contacts (B).



A—Steel Bolt
B—Lead Wire
C—Coil Base
D—Positive Battery Post
E—Negative Battery Post

Fig. 10-Testing PTO Clutch Field Coil

Remove the four cap screws from the field coil frame.

To test the field coil, attach the field coil lead wire (B) to the positive battery post (D). Set the coil base (C) on the negative battery post (E).

Place a steel bolt (A) across the coil. Electromagnetic action will hold the bolt to the coil if the PTO field is in good condition. If the bolt will not stick to the field coil, the coil is defective and must be replaced.

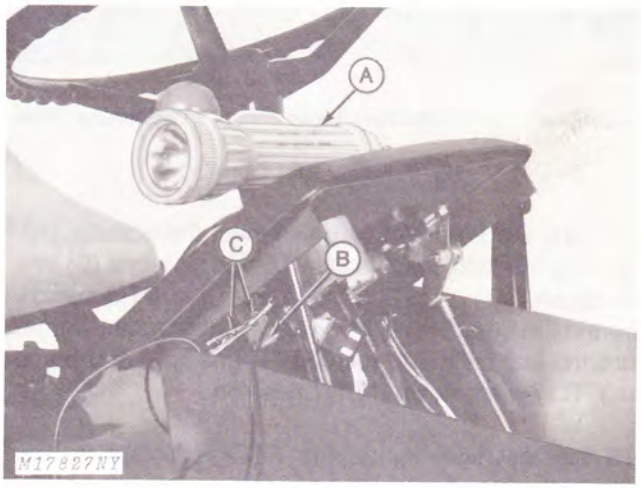
Lights (300 and 316 Tractors)

Following are some common causes of problems in the lighting circuit. If the lighting circuit fails, a visual inspection of connections, wiring harness, sockets and bulbs will usually detect the problem.

DIAGNOSING MALFUNCTIONS

Problem	Cause
Dim Lights	High resistance in circuit, or poor ground on lights. Low battery charge. Defective light switch or ignition switch.
Lights Burn Out Prematurely	Excessive voltage due to faulty regulator or ground wire on alternator. Wrong type bulb being used.
Light Fails to Work	Defective socket or bulb. Broken wire or disconnected coupler. Corroded connections. Switch failure.

Switches



A—Test Light **B—Light Switch** **C—Switch Terminals**

Fig. 11-Testing Light Switch on 300 and 316 Tractors

To test the light switch (B), Fig. 11, use a test light (A), and connect it to the switch terminals (C).

With the switch (B) on the "ON" position, the test light (A) will glow. With the switch (B) in the "OFF" position, the test light (A) should go out.

To test the ignition switch, see page 40-10-8.

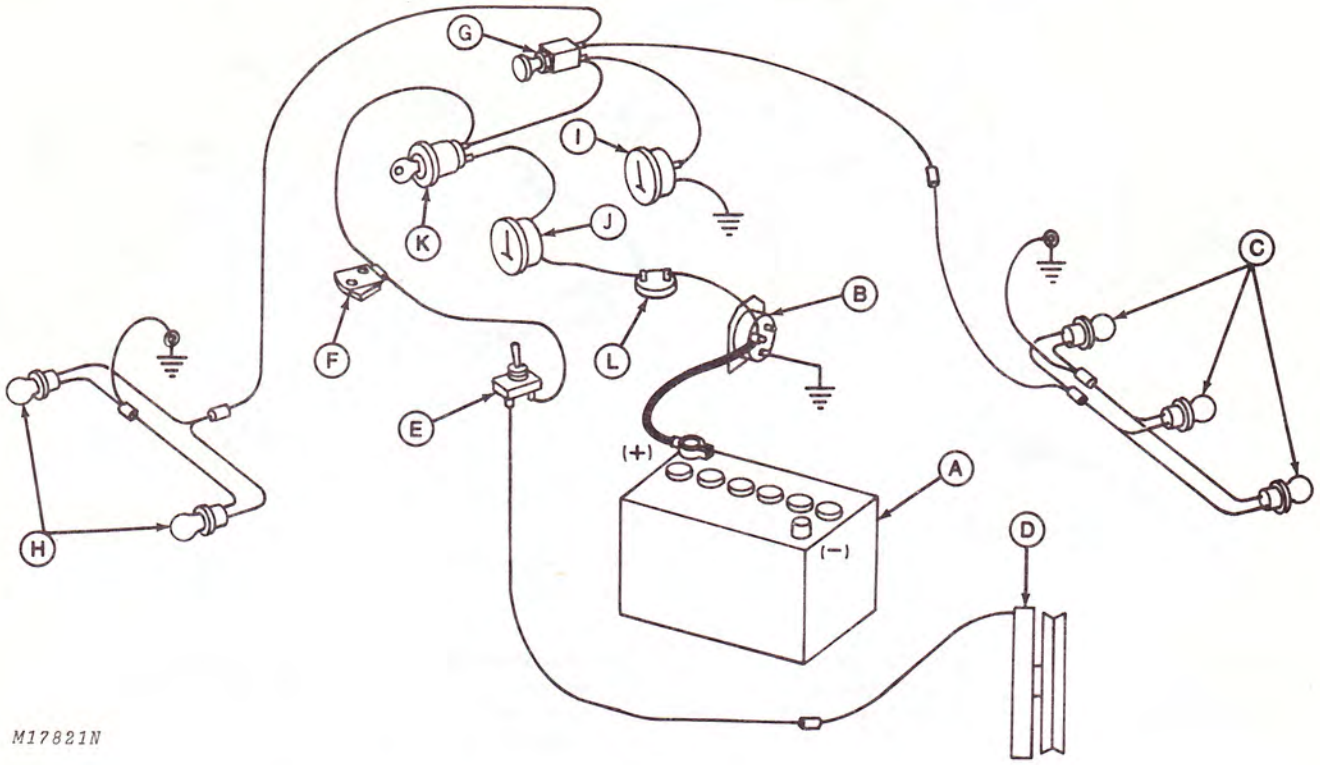
To test the PTO Clutch switch, see page 40-10-9.

Litho in U.S.A.

Group 30
PTO CLUTCH

GENERAL INFORMATION

PTO Clutch and Switch —300 Tractor (Serial No. 30,001-70,000)



A—Battery
B—Solenoid
C—Head Lights
D—PTO Clutch
E—PTO Switch
F—PTO Neutral-Start Switch
G—Light Switch
H—Taillights
I —Hourmeter (Serial No. 30,001-55,000)
J—Ammeter
K—Ignition Switch
L—Circuit Breaker

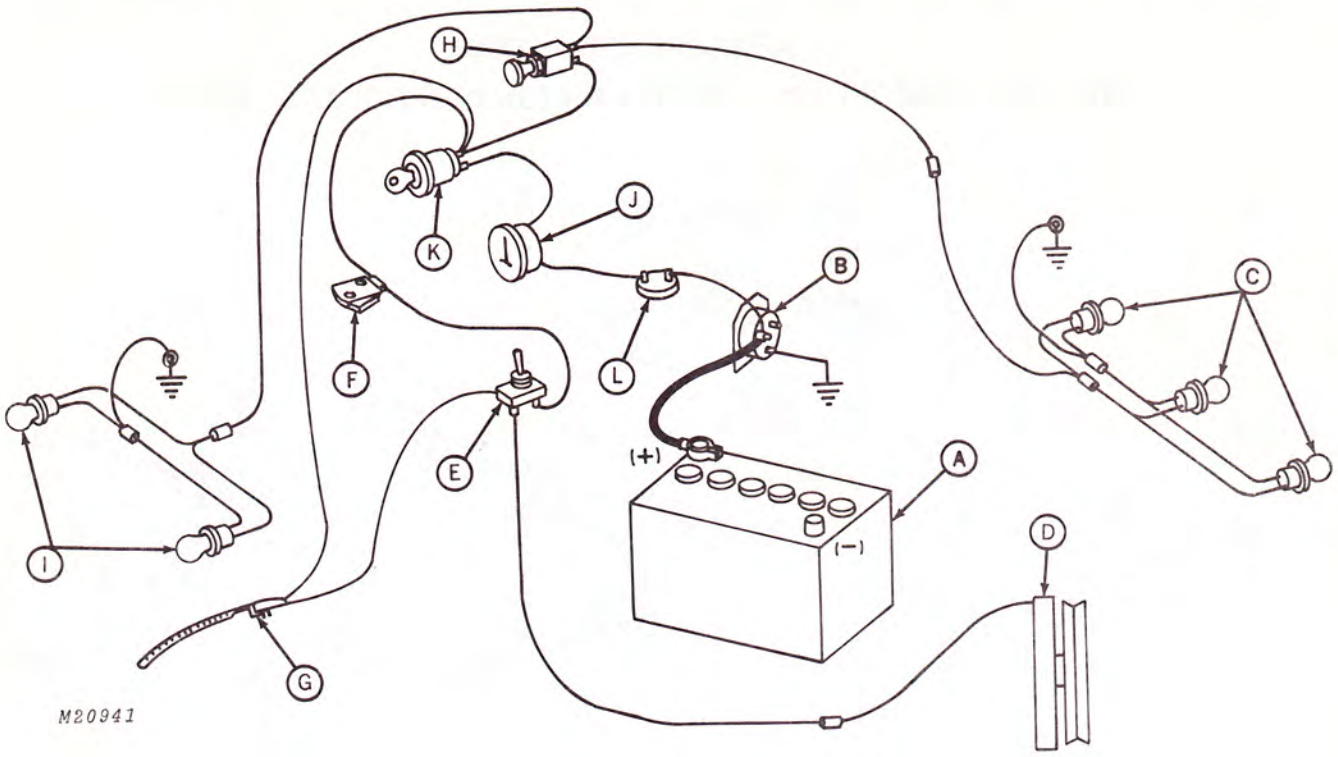
Fig. 1-Accessory Circuits

The PTO clutch (D) is activated with a PTO switch (E) located at the dash panel. The PTO switch also acts as a neutral-start switch that directs current from the solenoid terminal of the ignition switch (K) to the solenoid (B) when the PTO switch is in the "OFF" position.

When the PTO switch (E) is in the "ON" position, current is directed to the PTO clutch (D) activating the electro-magnet engaging the clutch.

Litho in U.S.A.

PTO Clutch and Switch —300 Tractor (Serial No. 70,001-80,000) And 316 Tractors



A—Battery
B—Solenoid
C—Head Lights
D—PTO Clutch
E—PTO Switch
F—PTO Neutral-Start Switch
G—Seat Safety-Start Switch
H—Light Switch
I —Taillights
J—Ammeter
K—Ignition Switch
L—Circuit Breaker

Fig. 2-Accessory Circuits

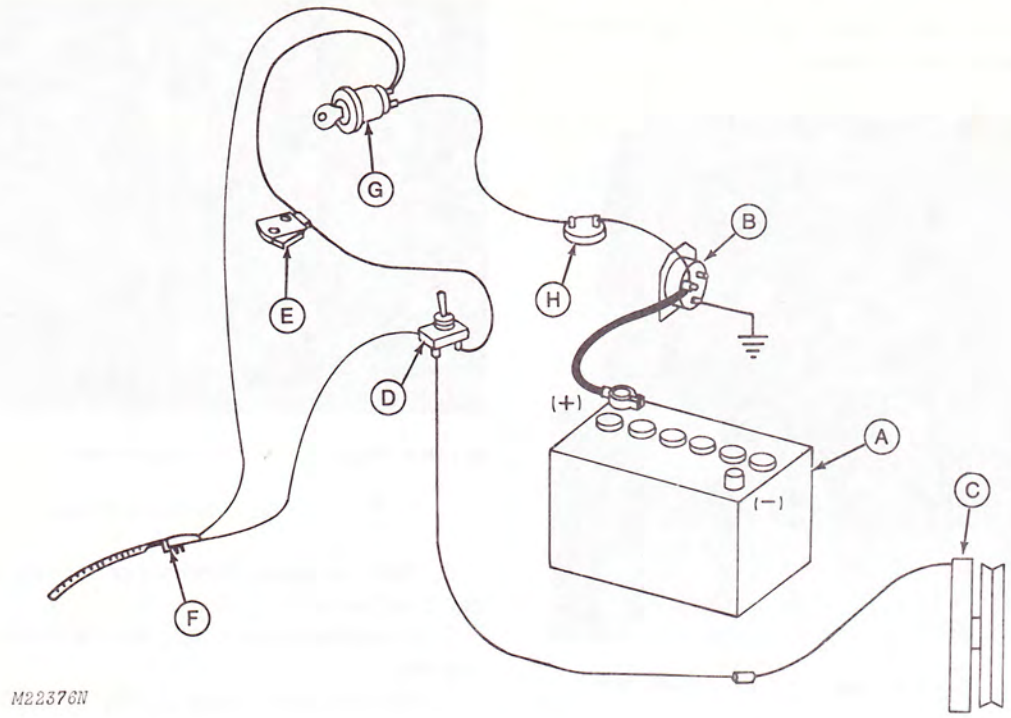
The PTO clutch (D) is activated with a PTO switch (E) located at the dash panel. The PTO switch also acts as a neutral-start switch that directs current from the solenoid terminal of the ignition switch (K) to the solenoid (B) when the PTO switch is in the "OFF" position.

When the PTO switch (E) is in the "ON" position, current is directed to the PTO clutch (D) activating the electro-magnet engaging the clutch.

NOTE: The tractor is equipped with a seat safety-start switch (G). The switch shuts off the engine whenever the operator leaves the seat with the engine running and the PTO engaged.

Litho in U.S.A.

PTO Clutch and Switch —312 and 314 Tractors



M22376N

A—Battery
B—Solenoid
C—PTO Clutch
D—PTO Switch
E—PTO Neutral-Start Switch
F—Seat Safety-Start Switch
G—Ignition Switch
H—Circuit Breaker

Fig. 3-Accessory Circuits

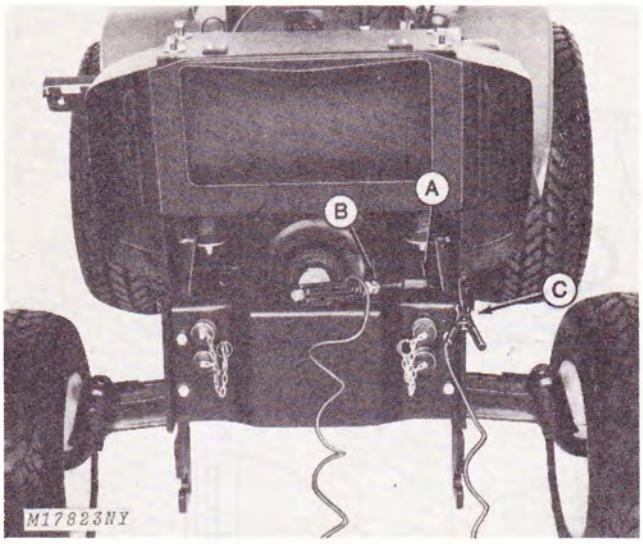
The PTO clutch (C) is activated with a PTO switch (D) located at the dash panel. The PTO switch also acts as a neutral-start switch that directs current from the solenoid terminal of the ignition switch (G) to the solenoid (B) when the PTO switch is in the "OFF" position.

When the PTO switch (D) is in the "ON" position, current is directed to the PTO clutch (C) activating the electro-magnet engaging the clutch.

NOTE: The tractor is equipped with a seat safety-start switch (F). The switch shuts off the engine whenever the operator leaves the seat with the engine running and the PTO engaged.

Testing PTO Clutch

NOTE: Check for faulty clutch switch, loose wiring or short circuit before testing clutch.

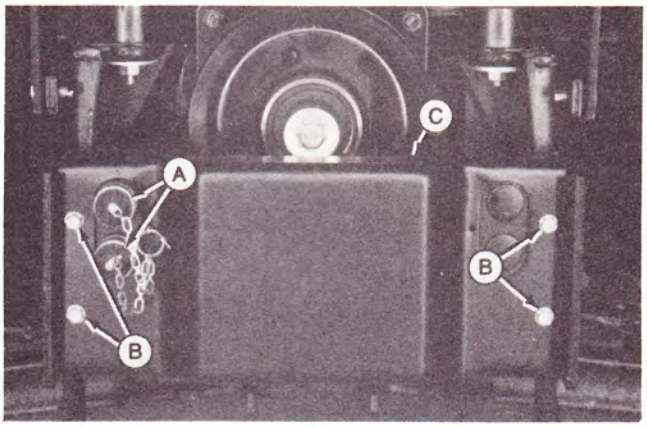


A—Coupler **B—Test Light** **C—Ground Wire**

Fig. 4-Testing PTO Clutch

1. Remove hood, hood support, grille and side panels. See Section 10, Group 20.
2. Disconnect coupler (A, Fig. 4).
3. Insert a 12-volt test light (B) into coupler (A) that leads from PTO switch. Ground test light to frame (C).
4. Turn key switch to "RUN" and place PTO switch "ON". On models with seat switch, make sure seat is down so switch is engaged.
5. If test light lights, there is continuity to PTO. This means PTO is defective, clutch needs adjusting, or connection between switch wire and field coil is bad. Check for wire rubbing on pulley or rotor.

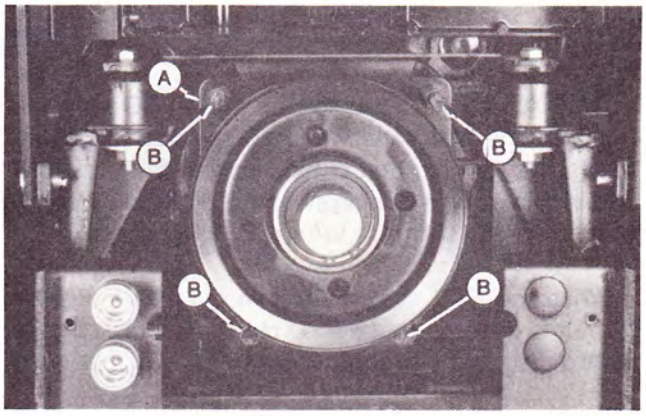
Adjusting PTO Clutch



A—Dust Plugs **B—Cap Screws** **C—Bumper**

Fig. 5-Removing Bumper

1. Remove hood, hood support, grille and side panels. See Section 10, Group 20.
2. Disconnect spark plug wire to prevent accidental starting.
3. Remove dust plugs (A, Fig. 5) from couplers.
4. Remove cap screws (B) and bumper (C).
5. Turn key switch to "RUN", place PTO switch "ON" and activate seat switch (if so equipped).

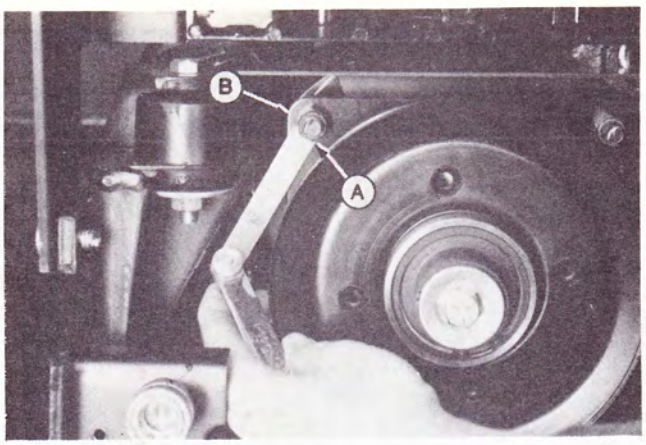


A—Braking Plate **B—Nuts**

Fig. 6-Adjusting Clutch — Preliminary Step

6. Push down on braking plate (A, Fig. 6) and tighten nuts (B) until there is no clearance between plate and nuts.

Litho in U.S.A.



A—Nut B—Backing Plate

Fig. 7-Adjusting Clutch

7. Back out nut (A, Fig. 7) and use flat feeler gauge to set clearance between nut (A) and braking plate (B) to 0.012 to 0.014 inch (3.048 to 3.556 mm).

NOTE: Repeat procedure on other three nuts.

8. Connect spark plug, start engine. Move PTO switch to "ON" and activate seat switch (if so equipped).
9. If clutch does not engage, remove clutch for inspection and test field coil.
10. If clutch does engage, install bumper, dust plugs, side panels, grille, hood support, and hood.

Identifying Clutch

Ogura or Warner clutches are used.

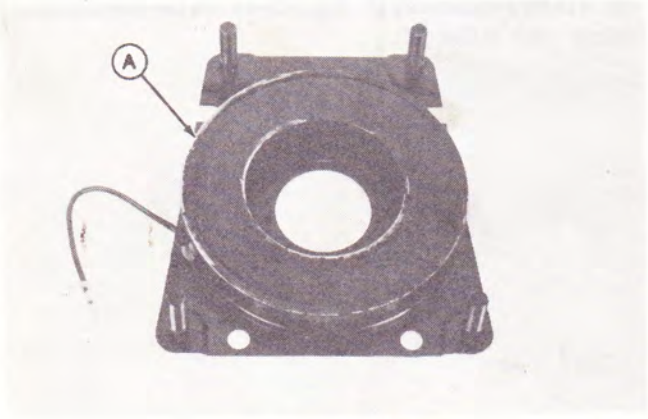


Fig. 8-Ogura Clutch Backplate

The Ogura clutch backplate (A, Fig. 8) has angled sides.

Litho in U.S.A.

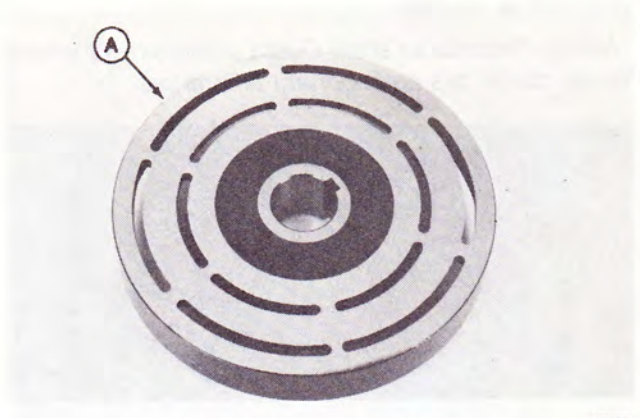


Fig. 9-Ogura Clutch Rotor

On the Ogura clutch, the hub is part of the armature, and the rotor face (A, Fig. 9) is flat.

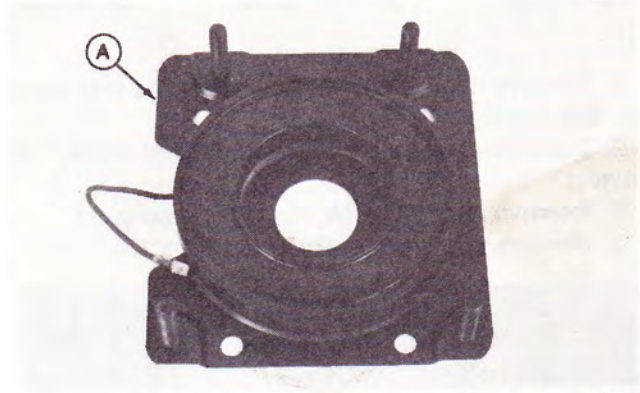


Fig. 10-Warner Clutch Backplate

The Warner Clutch backplate (A, Fig. 10) has square sides.

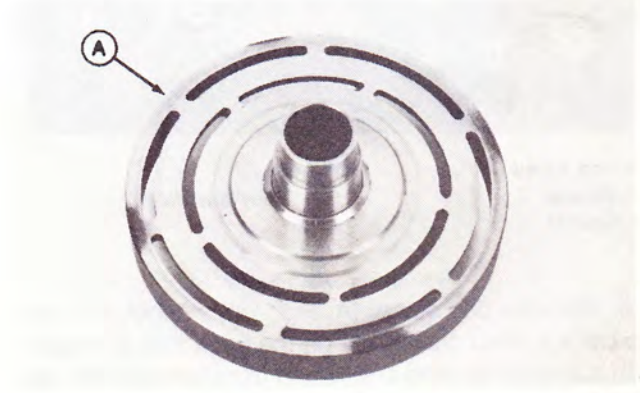


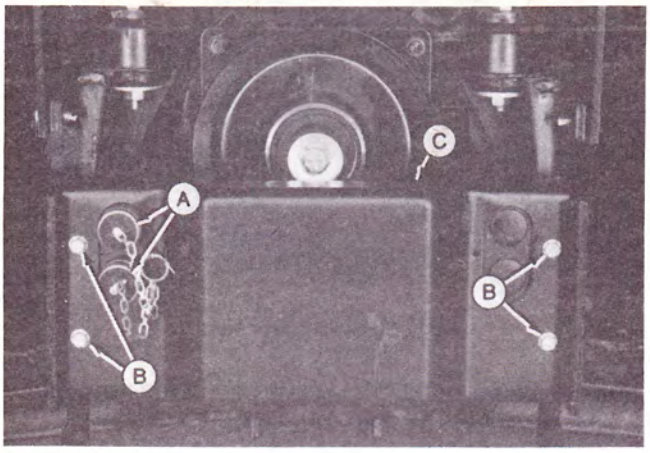
Fig. 11-Warner Clutch Rotor

On the Warner clutch, the hub is part of the rotor (A, Fig.11).

IMPORTANT: DO NOT transfer parts from Warner to Ogura clutches. Clutches are interchangeable as assemblies only.

Removing Clutch

NOTE: Procedures show Ogura clutch except where Warner clutch has an important difference.

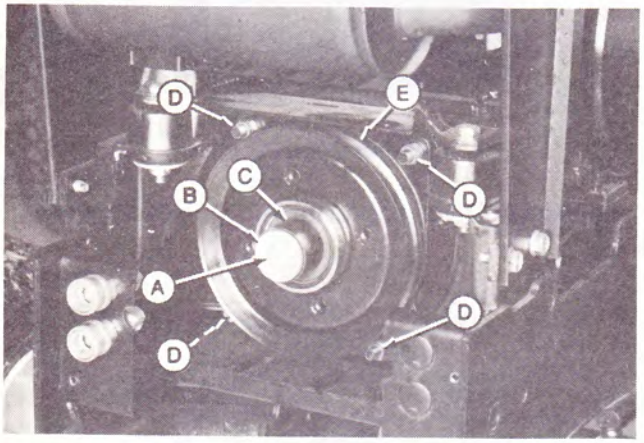


M30337

A—Dust Plugs **B—Cap Screws** **C—Bumper**

Fig. 12-Removing Bumper

1. Remove hood, hood support, grille and side panels. See Section 10, Group 20.
2. Disconnect spark plug wire to prevent accidental starting.
3. Remove dust plugs (A, Fig. 12) on couplers.
4. Remove cap screws (B) and bumper (C).



M30340

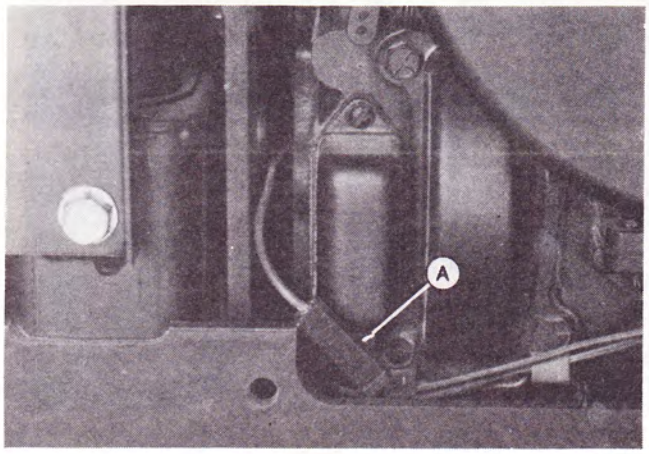
A—Cap Screw
B—Washer
C—Spacer
D—Nuts
E—Pulley Assembly

Fig. 13-Removing Pulley

5. Remove cap screw (A, Fig. 13), washer (B), and spacer (C). Hold drive shaft on the back side of engine with a wrench to keep crankshaft from turning with cap screw (A).

IMPORTANT: Nuts (D) must be removed before removing pulley assembly (E).

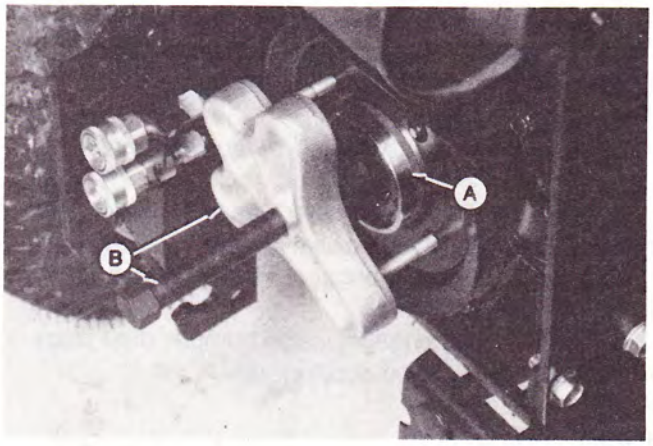
6. Remove nuts (D). Remove pulley assembly (E) from crankshaft. (On Warner clutch, rotor may come off with pulley assembly.)



M30341

Fig. 14-Disconnecting Coupler

7. Disconnect coupler (A, Fig. 14) located beneath air cleaner on left side of tractor.



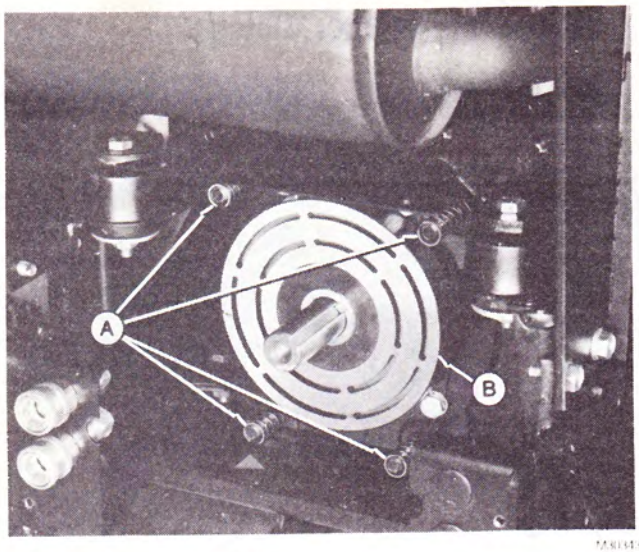
M30342

A—Pulley Assembly **B—Puller**

Fig. 15-Removing Pulley Assembly

8. If pulley assembly (A, Fig. 15) sticks on crankshaft, remove with puller (B).

Litho in U.S.A.



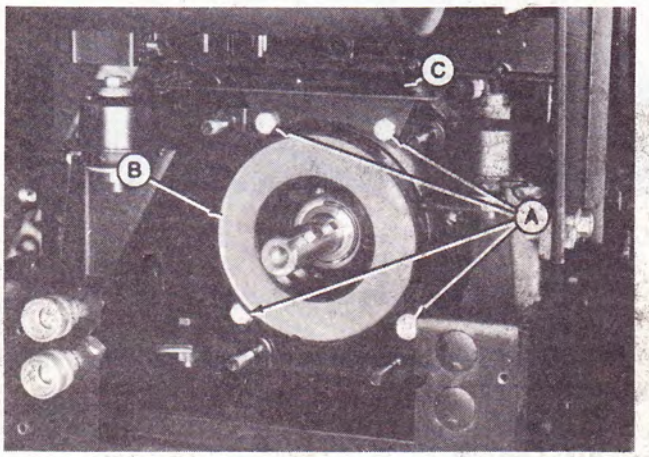
A—Springs B—Rotor

Fig. 16-Removing Springs and Rotor

9. Remove springs (A, Fig. 16).

NOTE: Rotor (B) is keyed to crankshaft. Be careful not to lose key.

10. Remove rotor (B).



A—Cap Screws and Lock Washers B—Coil C—Shield

Fig. 17-Removing Coil

11. Remove cap screws and lock washers (A, Fig. 17.)
12. Remove coil (B) and shield (C).

Disassembling Ogura Clutch

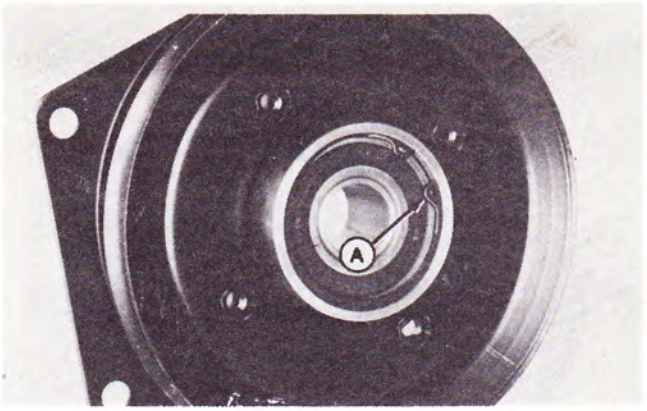
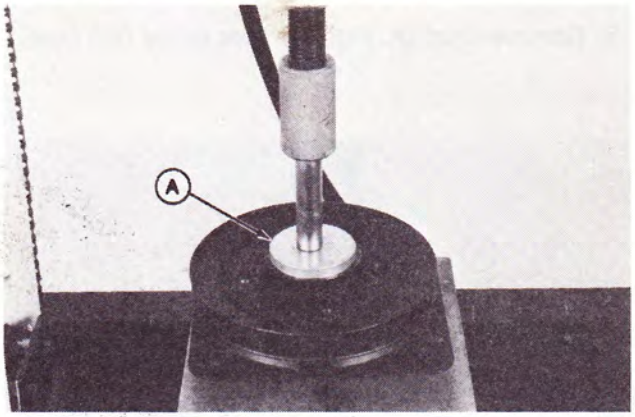


Fig. 18-Removing Snap Ring

1. Remove snip ring (A, Fig. 18).



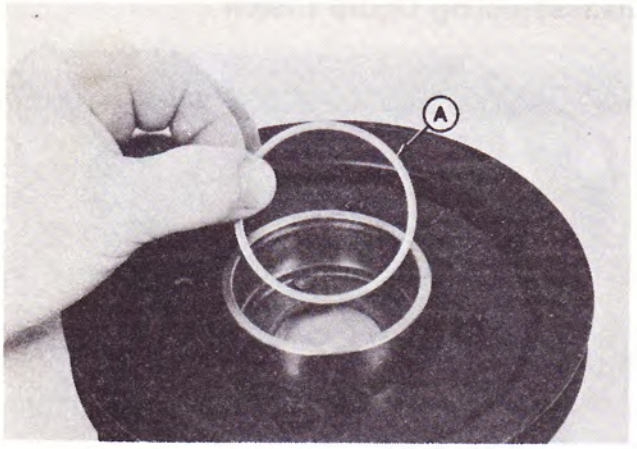
A—Bearing

Fig. 19-Removing Bear & Hub

IMPORTANT: Pulley sheave may be distorted if not supported near center. Do not let hub and bearing drop to floor.

NOTE: Use Owatonna Tool Company Driver Set, Disc #27505 to press out hub.

2. Support pulley as close to hub as possible, and press out hub and bearing (A, Fig. 19).

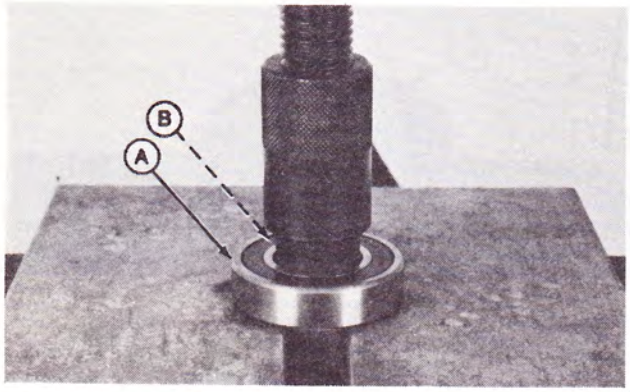


M28988

A—Shim

Fig. 20-Removing Shim

3. Remove shim (A, Fig. 20) from pulley hub bore.



M28989

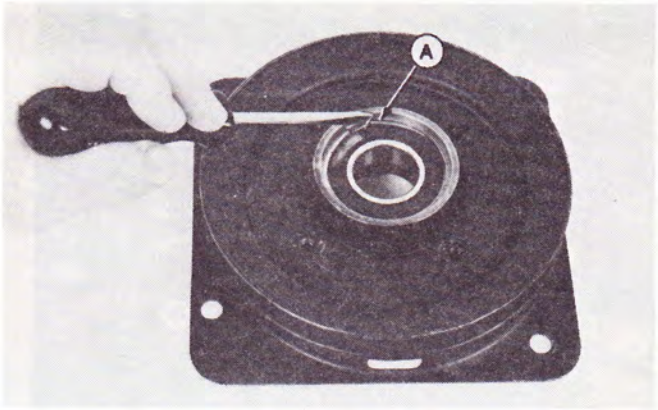
A—Bearing **B—Hub**

Fig. 21-Removing Hub

NOTE: Use Owatonna Tool Company Driver Set, Disc #27501 to press out hub.

4. Support bearing (A, Fig. 21) on inside diameter and press out hub (B).

Disassembling Warner Clutch

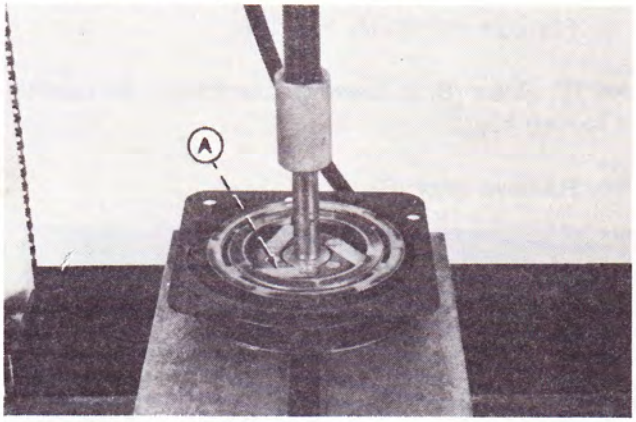


M28990

A-Snap Ring

Fig. 22-Removing Snap Ring

1. Remove snap ring (A, Fig. 22).



M28991

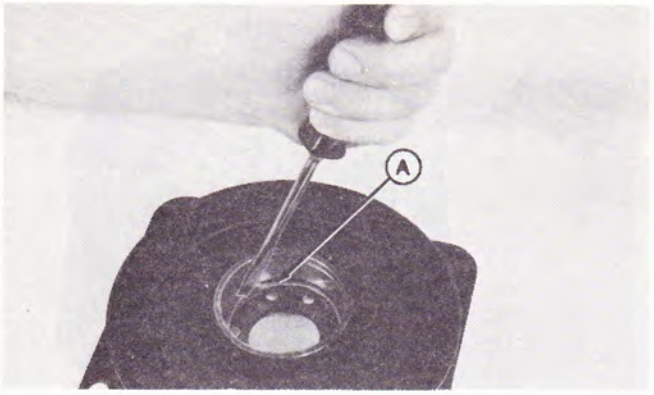
A—Bearing

Fig. 23-Removing Bearing

IMPORTANT: Pulley sheave may be distorted if not supported near center.

NOTE: Use Owatonna Tool Company Driver Set, Disc #27505 to press out bearing.

2. Support pulley as close to hub as possible, and press out hub and bearing (A, Fig. 23).



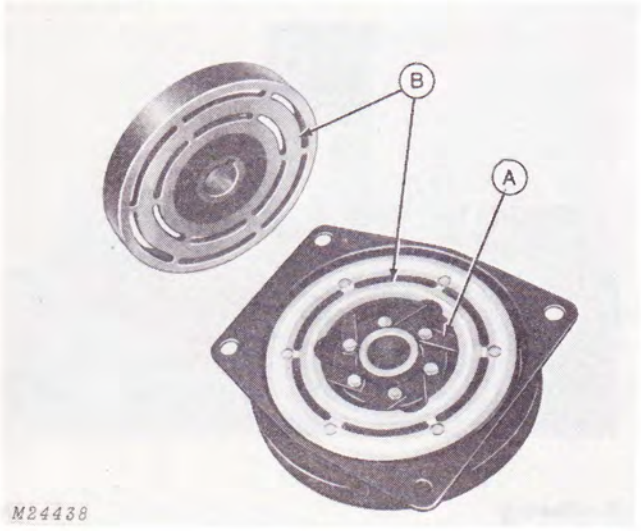
M28992

A—Snap Ring

Fig. 24-Removing Snap Ring

3. Remove snap ring (A, Fig. 24)

Inspecting Clutch Parts



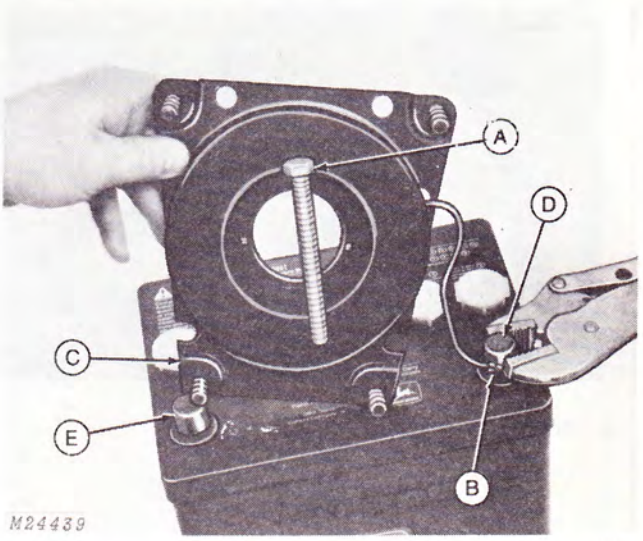
M24438

A—Springs **B—Armature Contacts**

Fig. 25-Inspecting Armature Contacts

1. Inspect armature for bent, weak or broken contact springs (A, Fig. 25). Replace armature if springs are damaged.
2. Check armature contacts (B) for dirt or paint. Clean if needed.
3. Inspect rotor and armature contacts (B) for wear. Replace if needed.

Testing Field Coil



M24439

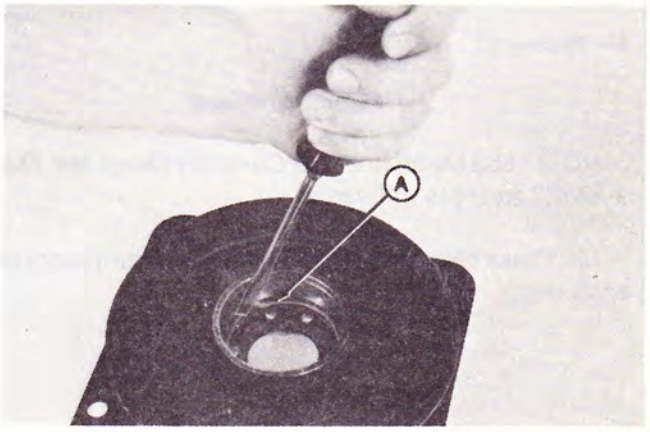
A—Steel Bolt
B—Lead Wire
C—Coil Base
D—Positive (+) Battery Post
E—Negative (−) Battery Post

Fig. 26-Testing Field Coil

NOTE: Chips in epoxy on face of coil are not a sign of a defective coil. Use tests below to determine if coil is good.

1. Attach field coil lead wire (B, Fig. 26) to positive (+) battery post (D). Set coil base (C) on negative (−) battery post (E).
2. Place steel bolt (A) across coil. Electromagnetic action will hold bolt to coil if PTO field is good. If bolt does not stick, replace coil.

Assembling Warner Clutch

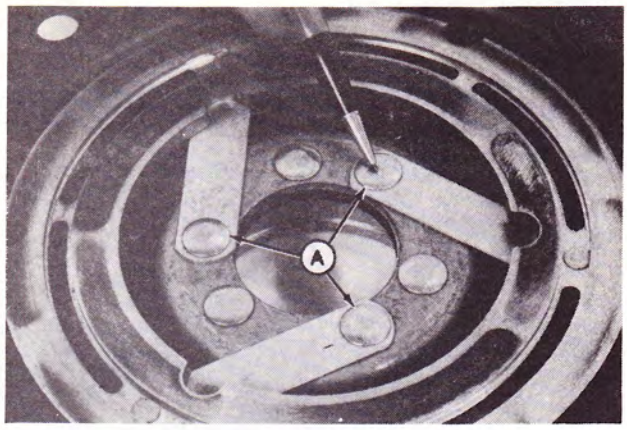


M28992

A—Snap Ring

Fig. 27-Installing Snap Ring

1. Install snap ring (A, Fig. 27) in lower hub groove.

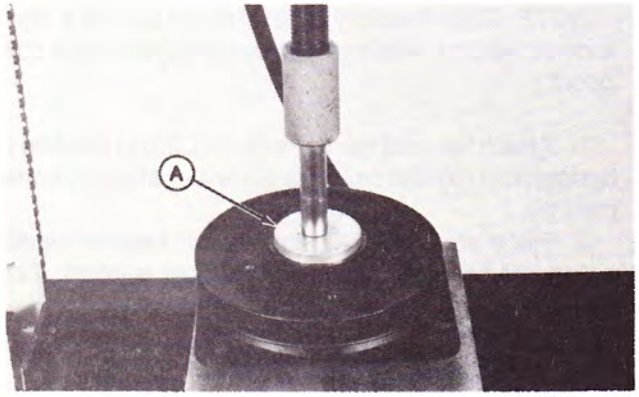


M28993

A—Rivets

Fig. 28-Support Points for Installing Bearing

IMPORTANT: In next step, installing bearing, support pulley so that press plate rests on rivets (A, Fig. 28) only. Armature and springs will be damaged if supported on armature or backplate.



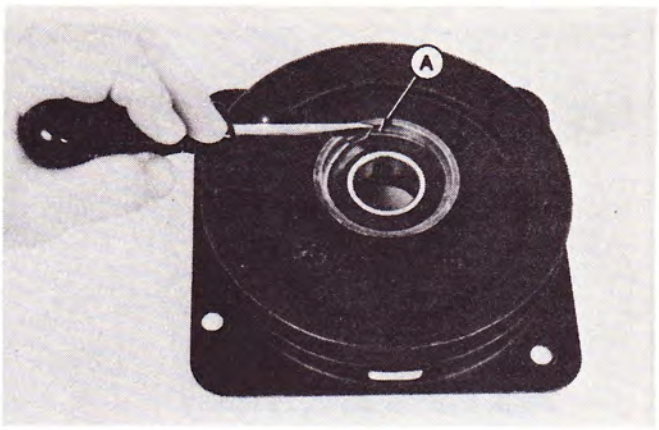
M28994

A—Bearing

Fig. 29-Installing Bearing

NOTE: Use Owatonna Tool Company Driver Set, Disc #27522 to press in bearing.

2. Press bearing (A, Fig. 29) into hub until it seats on snap ring.



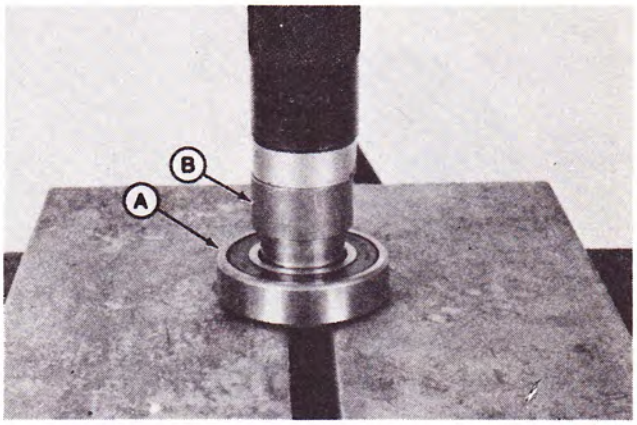
M28990

A—Snap Ring

Fig. 30-Installing Snap Ring

3. Install snap ring (A, Fig. 30).

Assembling Ogura Clutch



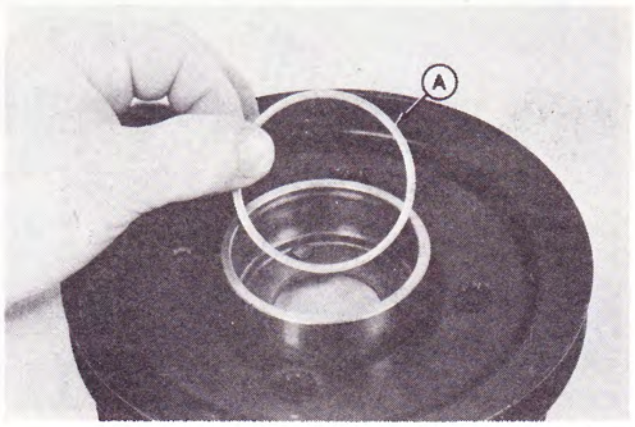
M28995

A—Bearing **B—Hub**

Fig. 31-Installing Hub

NOTE: Use Owatonna Tool Company Driver Set, Disc #27506 to press in hub.

1. Support bearing (A, Fig. 31) and press hub (B) into bearing.

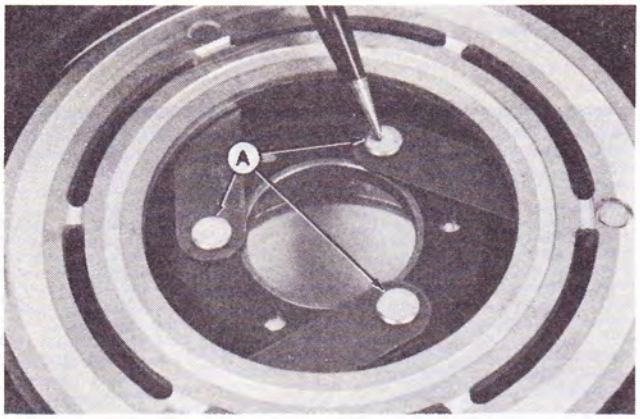


M28988

A—Shim

Fig. 32-Installing Shim

2. Install shim (A, Fig. 32) in hub bore.

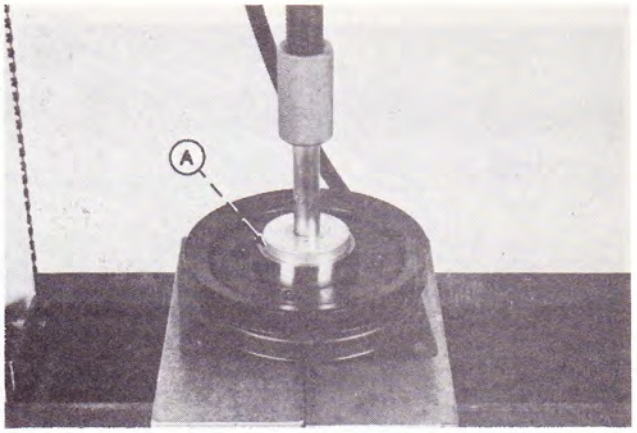


M28996

A—Rivets

Fig. 33-Support Points for Installing Bearing and Hub Assembly

IMPORTANT: In next step, installing hub and bearing assembly, support pulley so that press plate rests on rivets (A, Fig. 33) only. Armature and springs will be damaged if supported on armature or backplate.



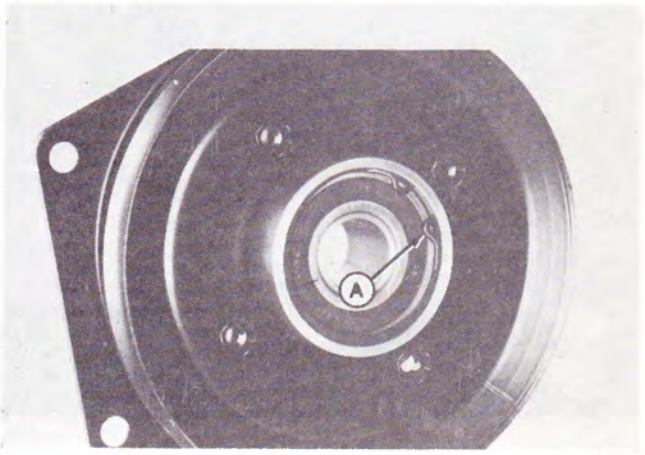
M28997

A—Bearing and Hub Assembly

Fig. 34-Installing Bearing & Hub Assembly

NOTE: Use Owatonna Tool Company Driver Set, Disc #27520 to press in bearing and hub.

3. Press bearing and hub assembly (A, Fig. 34) into pulley hub.



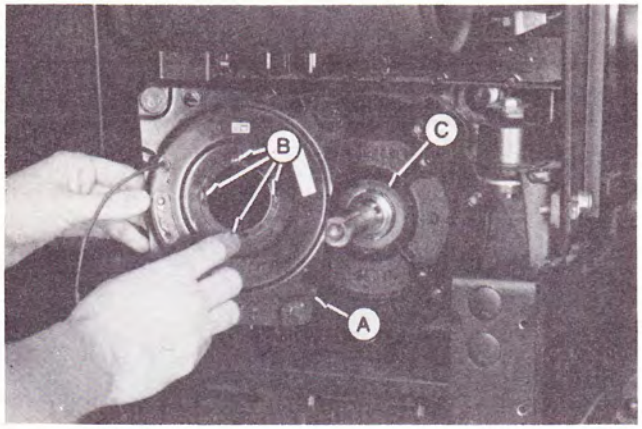
M28986

A—Snap Ring

Fig. 35-Installing Snap Ring

4. Install snap ring (A, Fig. 35).

Installing Clutch

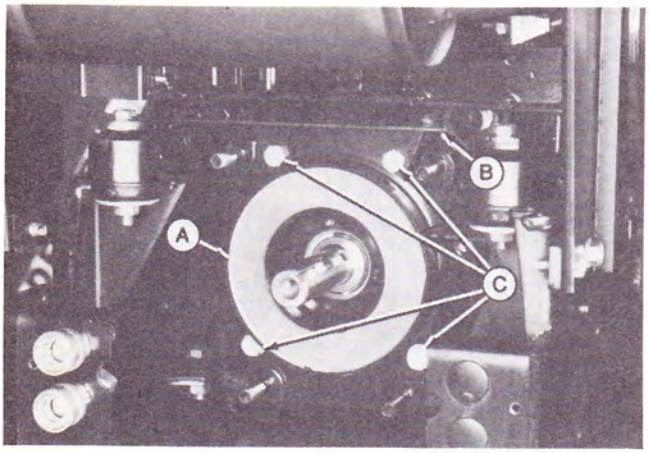


M30345

A—Coil **B—Locating Tabs** **C—Seal Bore**

Fig. 36-Positioning Coil

1. Place coil (A, Fig. 36) on engine block so that locating tabs (B) on back of coil engage in closure plate seal bore (C).

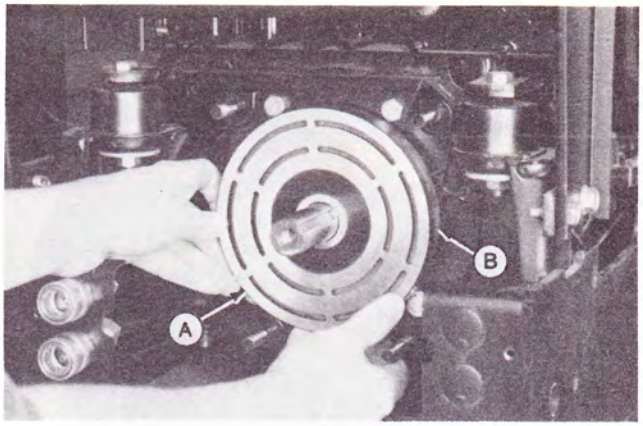


M30350

A—Coil **B—Shield** **C—Cap Screws Lock Washers**

Fig. 37-Installing Coil and Shield

2. Install coil (A, Fig. 37) and shield (B).
3. Install and tighten lock washers and cap screws (C).

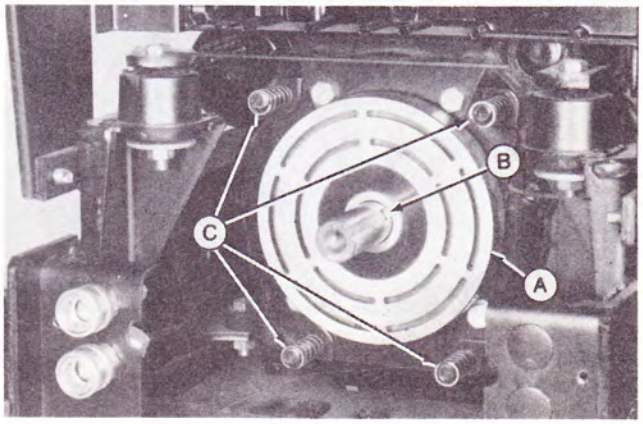


M30346

A—Rotor **B—Field Coil**

Fig. 38-Installing Ogura Clutch Rotor

4. Install Ogura clutch rotor as follows:
   A. Install rotor (A, Fig. 38) on crankshaft and over field coil (B).
   B. Rotate rotor (A) and check that it clears field coil (B).

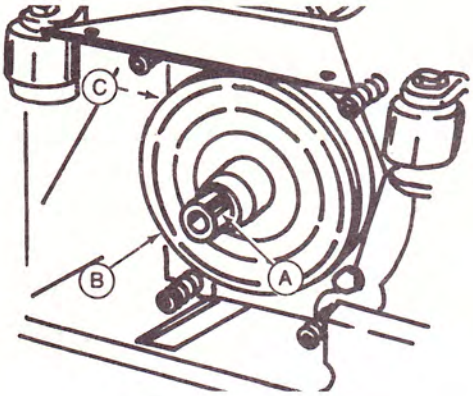


M30348

A—Rotor **B—Key** **C—Springs**

Fig. 39-Securing Ogura Clutch Rotor

   C. Pull rotor (A, Fig. 39) back and install key (B) in crankshaft.
   D. Move rotor (A) up to field coil and engage key (B).
   E. Install springs (C).



M30351

A—Key **B—Rotor** **C—Field Coil**

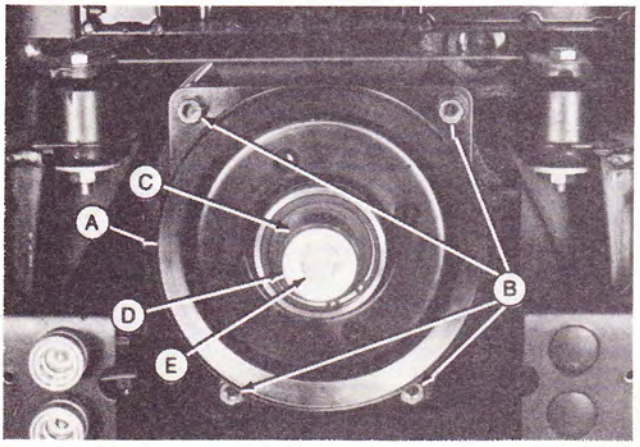
Fig. 40-Installing Warner Clutch Rotor

5. Install Warner clutch rotor as follows:

A. Set key (A, Fig. 40) on crankshaft and install rotor (B).

B. Rotate rotor (B) and check that it clears field coil (C).

C. Install springs.

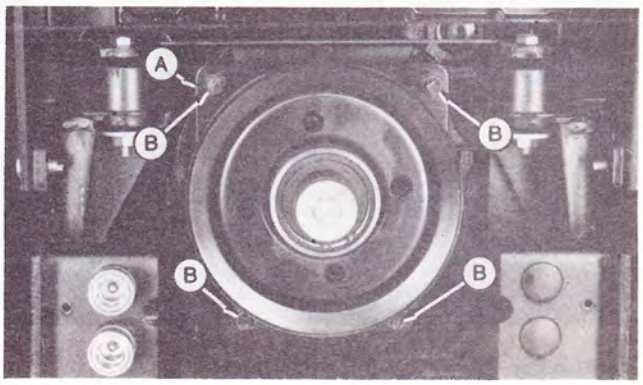


M30349

A—Pulley Assembly **D—Washer**
B—Nuts **E—Cap Screw**
C—Spacer

Fig. 41-Installing Pulley Assembly

6. Install pulley assembly (A, Fig. 41) and nuts (B).
7. Install spacer (C), washer (D) and cap screw (E).
8. Tighten cap screw (E) to 30 to 40 ft-lbs. (41 to 54 Nm) torque.
9. Connect wiring at coupler.

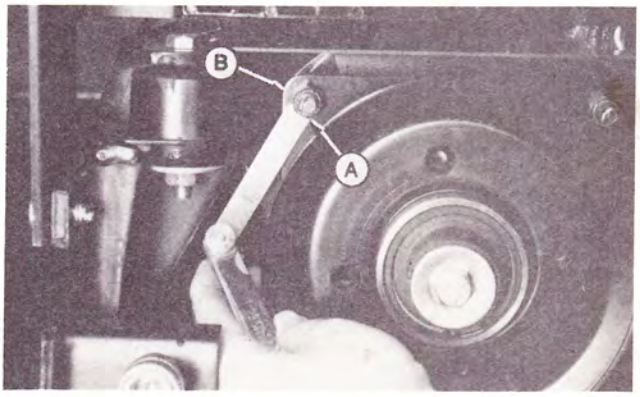


M30338

A—Braking Plate **B—Nuts**

Fig. 42-Adjusting Clutch, Preliminary Step

10. Turn key switch to "RUN" and move PTO switch to "ON".
11. Push down on braking plate (A, Fig. 42) and tighten nuts (B) until there is no clearance between plate and nuts.

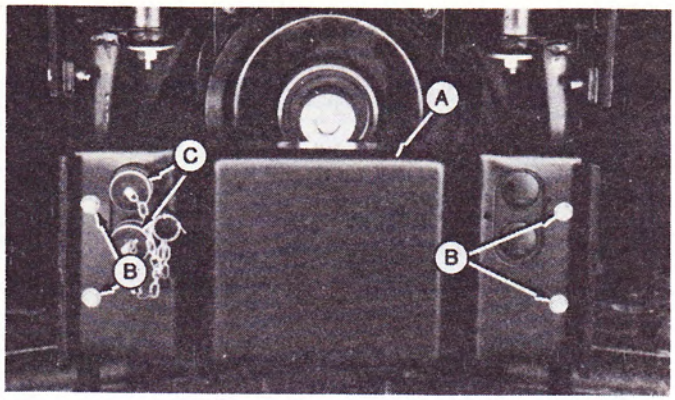


M30339

A—Nut **B—Braking Plate**

Fig. 43-Adjusting Clutch

12. Back out each nut (A, Fig. 43) and use flat feeler gauge to set clearance between each nut (A) and braking plate (B) to 0.012 to 0.014 inch (3.048 to 3.556 mm).
13. Connect spark plug wire to spark plug and start engine. Move PTO switch to "ON" and engage seat switch. Check clutch engagement.



M30352

A—Bumper
B—Cap Screws
C—Dust Plugs

Fig. 44-Installing Bumper

14. Install bumper (A, Fig. 44) and cap screws (B).
15. Install dust plugs (C) on couplers.
16. Install side panels, grille, hood support and hood. See Section 10, Group 20.

Section 50
POWER TRAIN
Group 5
GENERAL INFORMATION

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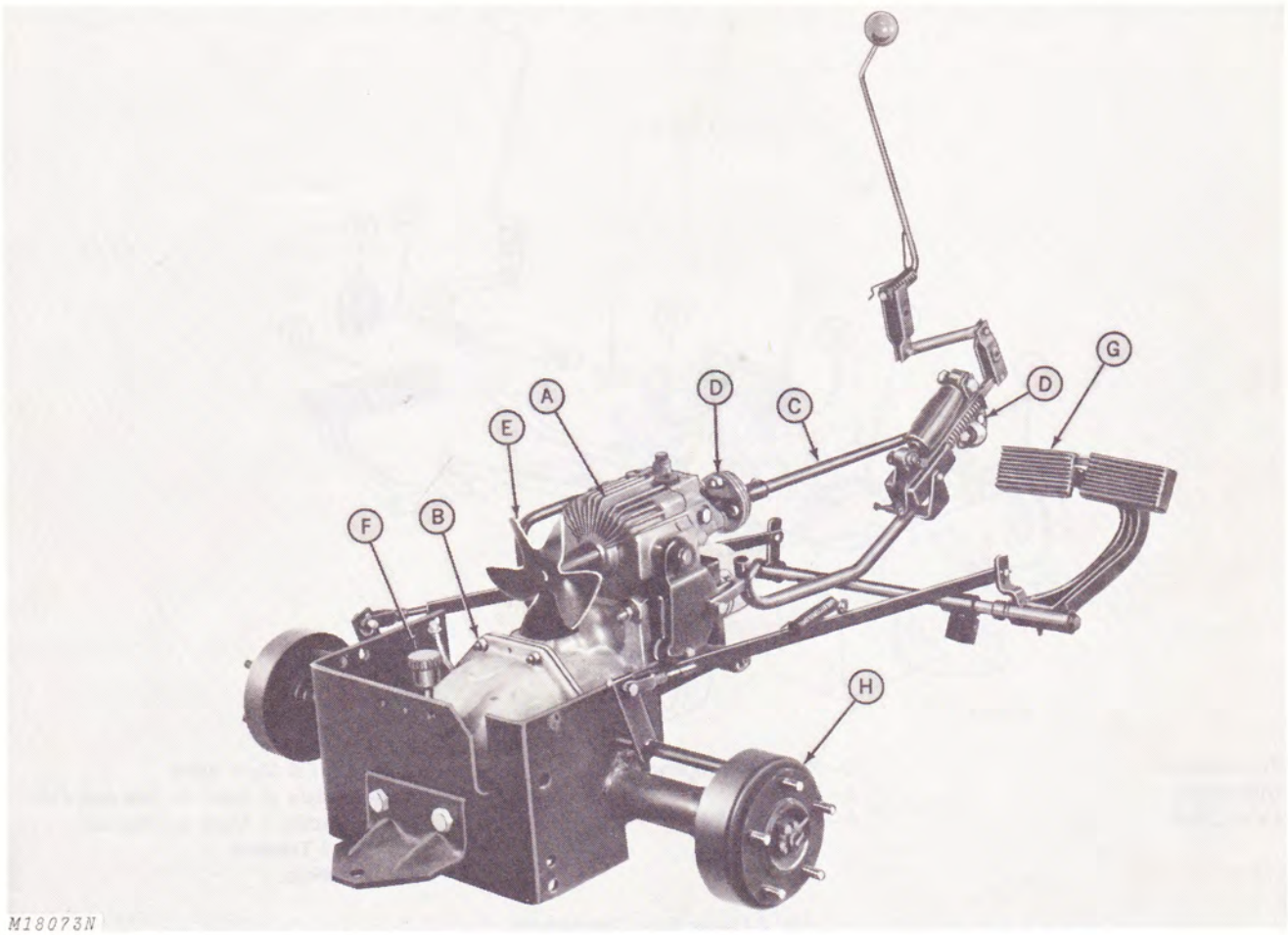
DESCRIPTION

300 Tractor (Serial No. 30,001-55,000)



A—Transmission
B—Differential
C—Drive Shaft
D—Flexible Couplings
E—Fan
F—Oil Fill Tube
G—Pedals
H—Brakes

Fig. 1-Power Train Components

The 300 Hydrostatic Tractor Power Train, (Serial No. 30,001-55,000), Fig. 1, consists of a hydrostatic transmission (A), heavy-duty differential and axle (B) linked to the engine with a drive shaft (C) and flexible couplings (D).

The transmission regulates the speed and direction of rotation of the differential gears and axle shafts, propelling the tractor.

A cooling fan (E), Fig. 1, blows air over the fins on the aluminum transmission housing to cool the oil in the hydrostatic circuit. This oil also operates the tractor-implement lift system and lubricates all the parts of the transmission, differential and axle.

A dipstick in the oil fill tube (F), Fig. 1, is used to check the transmission oil level.

Separate pedals (G) are used for braking; one for each rear wheel. The individual drum-type brakes (H) can be locked together for parking, or used individually for making tight turns.

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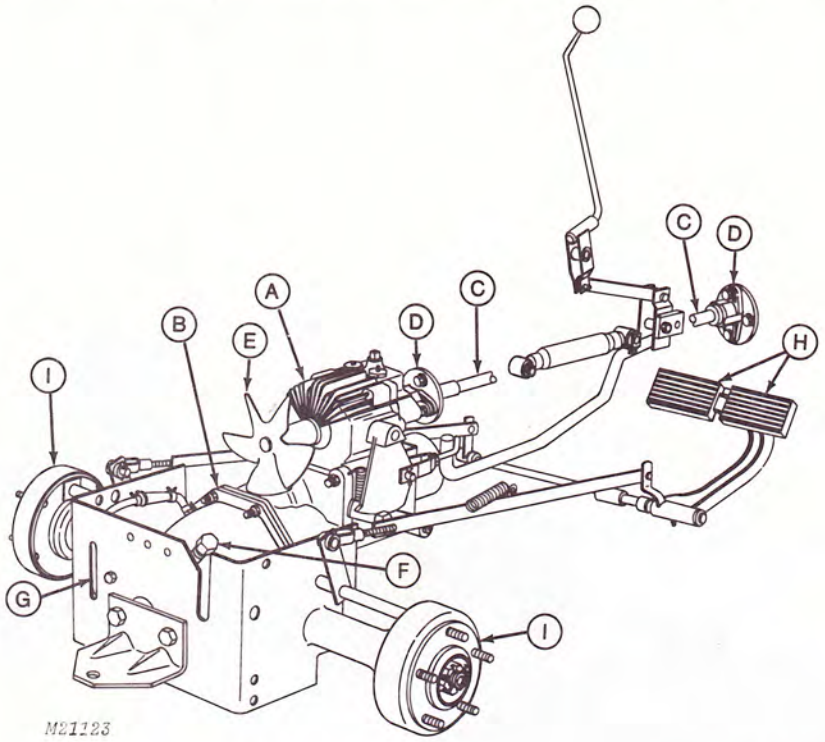
DESCRIPTION—Continued

300 Tractor (Serial No. 55,001-80,000) 312, 314 and 316 Tractors



A—Transmission
B—Differential
C—Drive Shaft
D—Flexible Couplings
E—Fan
F—Oil Fill Tube
G—Oil Fill Sight Tube
H—Pedals (2 Used on 300 and 316 Tractor, 1 Used on 312 and 314 Tractor)
I —Brakes

Fig. 2-Power Train Components

The 300 Tractor (Serial No. 55,001-80,000), and 312, 314 and 316 Tractor Hydrostatic Power Train, Fig. 2, consists of a hydrostatic transmission (A), and a heavy-duty differential and axle (B) linked to the engine by a drive shaft (C) and flexible couplings (D).

The transmission regulates the speed and direction of rotation of the differential gears and axle shafts, propelling the tractor.

A cooling fan (E), Fig. 2, blows air over the fins on the aluminum transmission housing to cool the oil in the hydrostatic circuit. This oil also operates the tractor-implement lift system and lubricates all the parts of the transmission, differential and axle.

300 Tractors prior to Serial No. 71,161, are equipped with a dipstick for checking the transmission oil level.

300 Tractors Serial No. 71,161-80,000, and all 312, 314 and 316 Tractors, are equipped with a flexible polyethylene oil fill sight tube (G), Fig. 2, which permits the operator to visually check the transmission oil level while the engine is stopped.

NOTE: The tractor engine must be stopped when checking or adding fluid to transmission on 300 Tractors Serial No. 71,161-80,000, and all 312, 314 and 316 Tractors.

On the 300 Tractor and 316 Tractor, separate brake pedals (H) are used for braking—one for each rear wheel. The individual drum-type brakes (I) can be locked together for parking or transporting, and unlocked for use individually when making tight turns.

On the 312 and 314 Tractor, a single brake pedal serves as a parking brake when locked in the depressed position.

NOTE: 314 Tractors are equipped with a built-in interlock which prevents the hydrostatic control lever from being moved out of "N" neutral position when parking brake is on.

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Group 10
DRIVE SHAFT, COUPLINGS AND BRAKES

PRINCIPLE OF OPERATION

Couplings

300 Tractor (Serial No. 30,001-70,000)

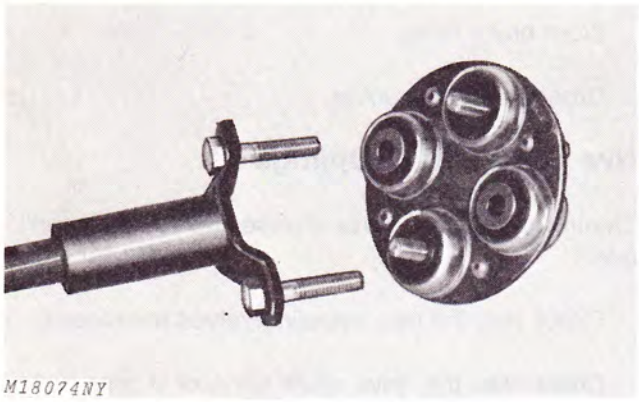


Fig. 1-Flexible Coupling at Engine

A flexible coupling, Fig. 1, connects the engine to the drive shaft, and also serves as a vibration dampener.

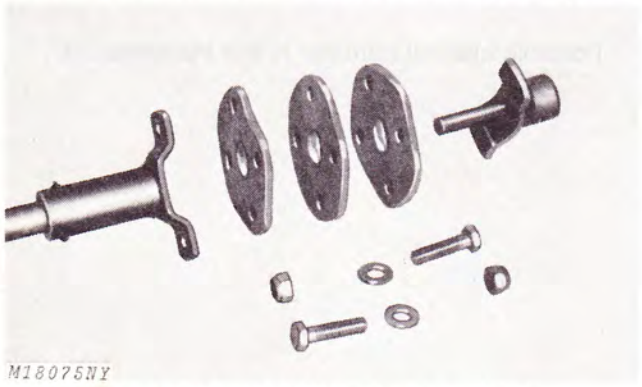


Fig. 2-Flexible Disk Coupling at Transmission

A flexible disk coupling on the transmission end of the drive shaft, Fig. 2, allows for some misalignment between the engine and transmission. Its function is similar to that of a universal joint.

Couplings

300 Tractor (Serial No. 70,001-80,000) 312, 314 And 316 Tractors

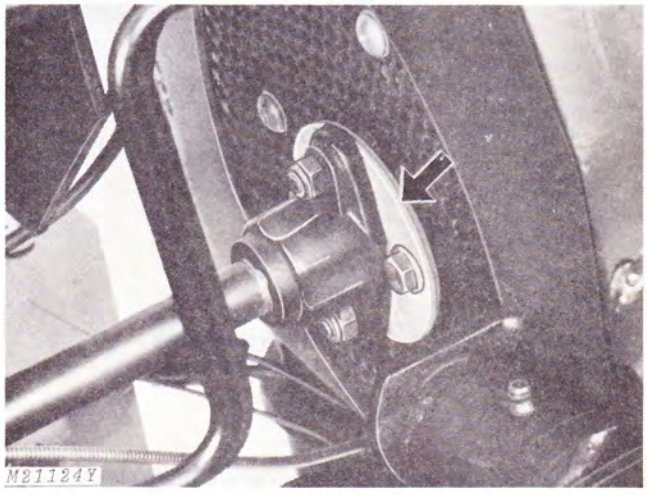


Fig. 3-Plastic Disk Couplings at Engine

Two reinforced plastic disks (arrow), Fig. 3, are assembled between the drive shaft coupling and engine hub. The disks allow for some misalignment between the engine and transmission.

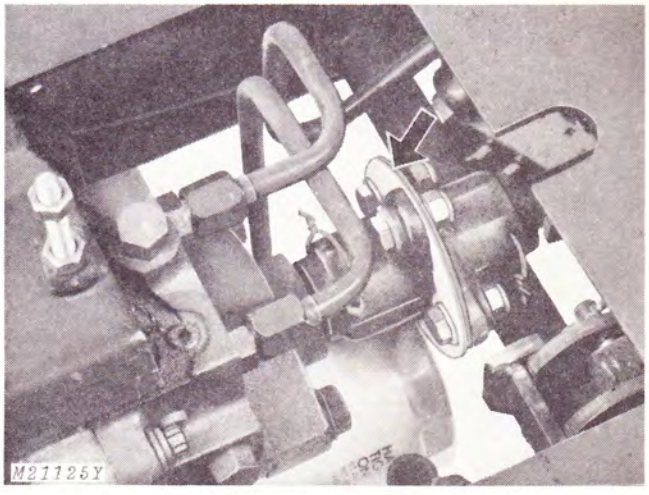
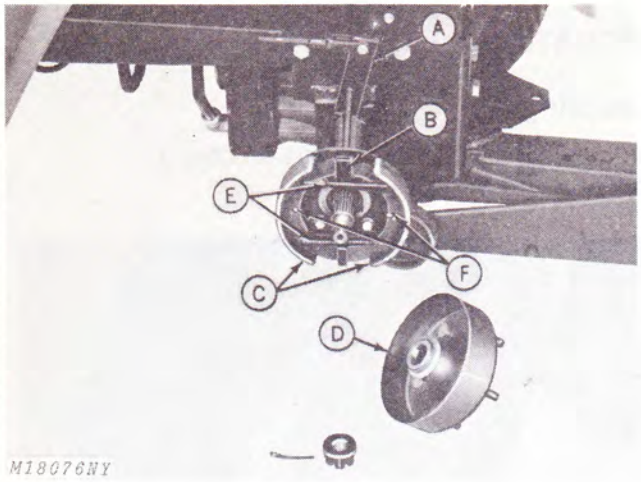


Fig. 4-Plastic Disk Couplings at Transmission

Two reinforced plastic disks (arrow), Fig. 4 are connected between the drive shaft and transmission couplings. The disks serve as a vibration dampener.

PRINCIPLE OF OPERATION—Continued

Brakes



A—Brake Lever
B—Cam
C—Brake Shoes
D—Brake Drum

Fig. 5-Brakes

Depressing the brake pedals moves brake levers (A, Fig. 5.) forward.

Forward movement of the brake levers rotates cams (B) which force brake shoes (C) outward against brake drums (D). This action slows and stops the tractor.

DIAGNOSING MALFUNCTIONS

Brakes

Brakes not effective:

Brakes not properly adjusted.

Groove pins on brake shaft sheared.

Worn brake lining.

Grease on brake lining.

Drive Shaft and Couplings

Control lever in forward or reverse and tractor doesn't move:

Check that the free wheeling valves are closed.

Check that the drive shaft turns or if pins have sheared or fallen out at the drive shaft hubs.

Check that plastic disks or couplings connecting drive shaft to engine and transmission are not broken.

Possible internal damage to the transmission.

REPAIR

Replacing Drive Shaft Assembly on 300 Tractors (Serial No. 30,001-70,000)

⚠ CAUTION: When removing the drive shaft assembly, disconnect the battery to prevent shorting the solenoid with hand tools when working on the front flexible coupling.

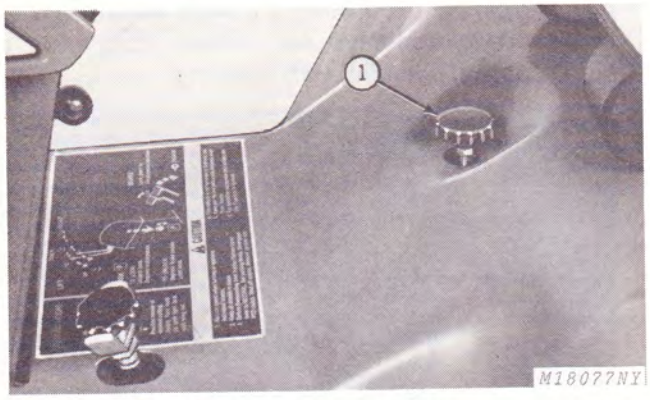


Fig. 6-Free-Wheeling Knob

1. Turn the free-wheeling knob down to open the check valves at the transmission.

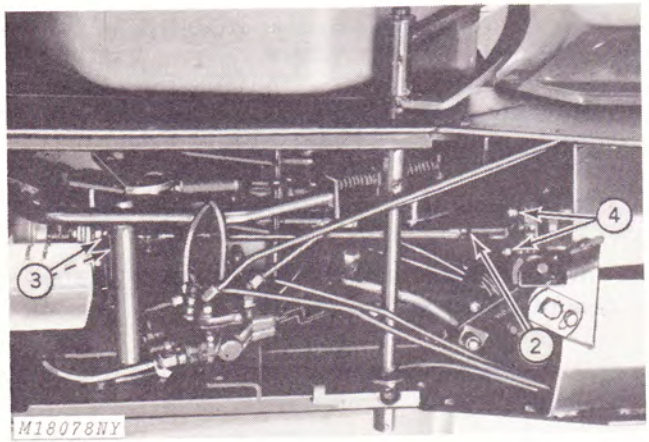


Fig. 7-Removing Drive Shaft

2. Remove wire and drive groove pin from the front yoke and drive shaft.

3. Remove two nuts and bolts on the yoke at the transmission flexible coupling.

4. Remove the two bolts from the front yoke. Slide the yoke to the rear and pull the drive shaft out the bottom of the tractor.

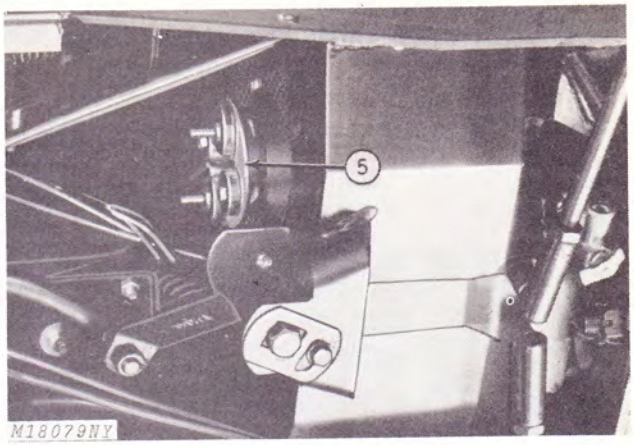


Fig. 8-Removing Front Coupling

5. Remove the front flexible coupling from the engine hub. Inspect flex coupling and hub for wear.

Reinstall front flexible coupling and drive shaft in reverse order of removal.

Replacing Drive Shaft, Disks, or Couplings—300 Tractor (Serial No. 70,001-80,000) 312, 314 and 316 Tractors

⚠ CAUTION: When removing the drive shaft assembly, disconnect the battery to prevent shorting the solenoid with hand tools when working on the front flexible coupling.

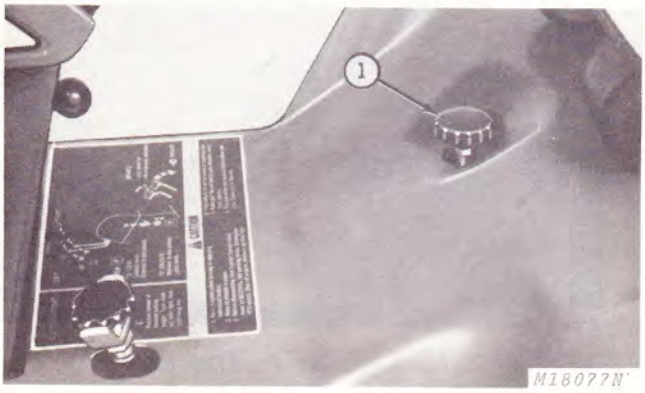


Fig. 9-Free-Wheeling Knob

1. Turn the free-wheeling knob down to open the check valves at the transmission.

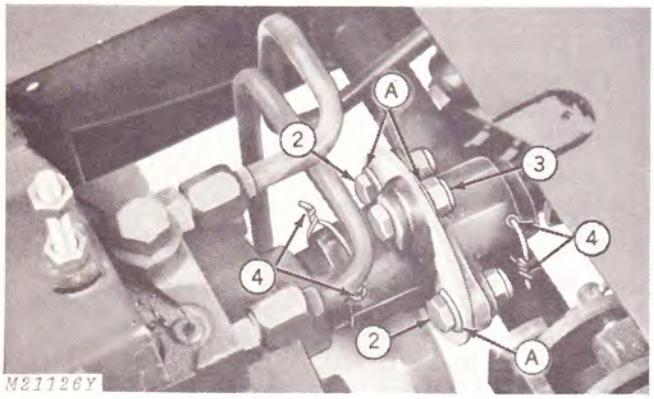


Fig. 10-Replacing Disks or Couplings at Transmission End

2. To replace plastic disks, remove two bolts securing drive shaft coupler to disks.

3. Remove other two bolts securing disks to transmission coupling. Remove disks.

4. On 300, 312, 316 and early production 314 Tractors, remove wire from pin and drive pin out of each coupling. On later Model 314 Tractors, it is necessary to remove transmission from tractor before attempting to remove pin. See note at right above.

NOTE: A transmission drive hub repair kit with installation instructions is furnished for service repair.

NOTE: If drive shaft requires replacement, it is necessary to remove couplings from drive shaft. Coupling securing drive shaft to transmission shaft on early production 314 Tractors, is secured in place with a spring or spiral pin, Fig. 10. On later production 314 Tractors, the coupling is secured to transmission shaft with a solid groove pin. On later production 314 Tractors, it is necessary to remove the transmission and press the solid pin out of shaft and coupling in an arbor press. The transmission shaft must be supported when pressing pin out of coupling and shaft. All transmission service couplings have set screws. Installation instructions are provided with coupling.

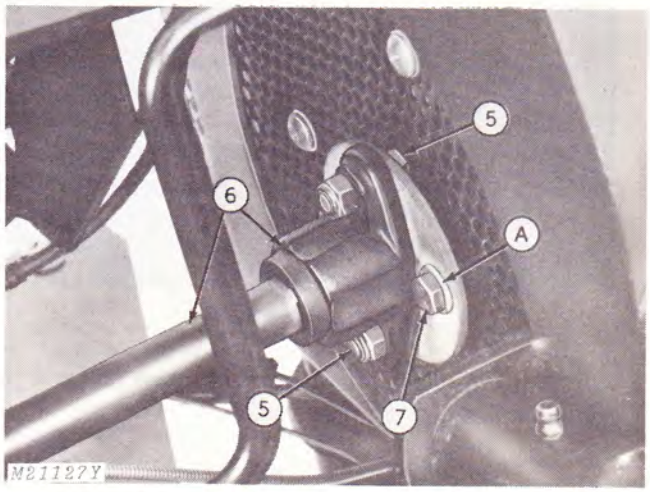


Fig. 11-Replacing Disks or Couplings at Engine

5. Remove two bolts securing drive shaft coupling to disks.

6. Slide drive shaft coupling back on shaft.

NOTE: The coupling is keyed to the drive shaft. Be careful not to lose the key.

7. Remove two bolts securing disks to engine hub. Remove disks.

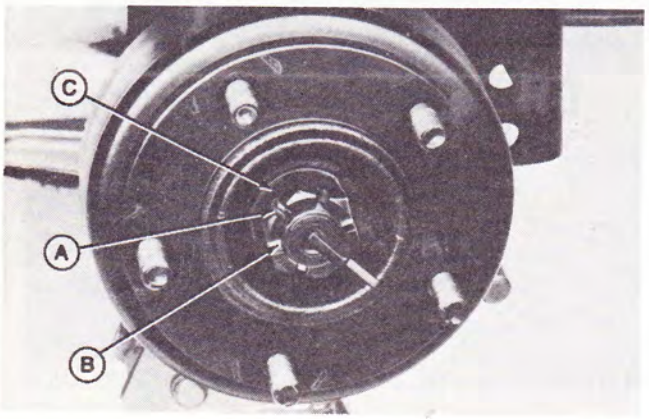
IMPORTANT: Be sure to assemble the disks with washers (A), Figs. 10 and 11, in the proper place. Otherwise damage to disks, couplings, drive shaft, or other related parts may occur.

Reinstall disks, couplings, or drive shaft in reverse order of removal.

IMPORTANT: Be sure to assemble plastic disks on coupling pilots before tightening bolts. Otherwise, damage to plastic disks will occur from misalignment when bolts are tightened.

Litho in U.S.A.

REMOVING BRAKE SHOES AND DRUM



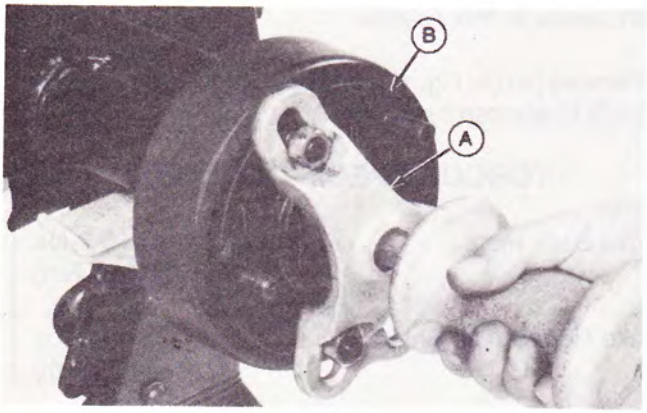
M28857

A—Cotter Pin
B—Nut
C—Washer

Fig. 12-Removing Brake Drum

Block up tractor so rear wheels clear ground, and remove rear wheels.

Remove cotter pin (A, Fig. 12), nut (B) and washer (C).

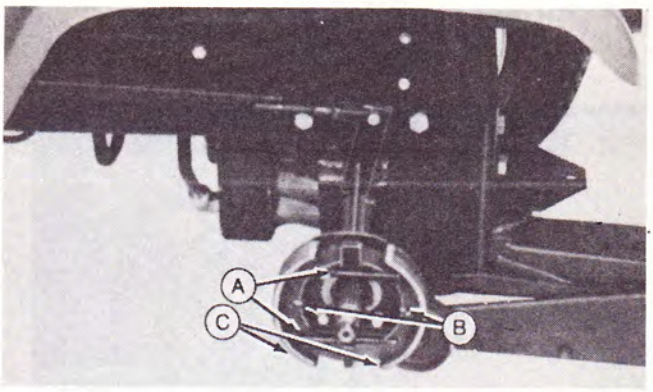


M28858

A—Brake Drum Puller
B—Brake Drum

Fig. 13-Installing Brake Drum Puller

Install OTC-967-C Brake Drum Puller (A, Fig. 13), and pull brake drum (B) from axle shaft.



M28859

A-Springs
B-Springs
C—Brake Shoes

Fig. 14-Removing Brake Shoes and Inspecting Brake Lining

Remove springs (A, Fig. 14) and unlatch springs (B). Remove brake shoes (C).

INSPECTING BRAKE PARTS

Brake Linings

Examine lining on brake shoes for wear and oil contamination. Replace shoes and linings if worn badly.

Replace axle oil seals if oil contamination is found on linings. See page 50-25-2.

Brake Drums

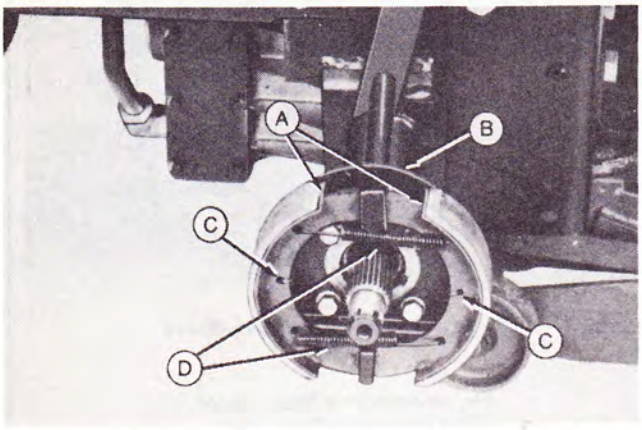
Replace brake drums if they are found to be worn or damaged.

To replace brake drum, press out wheel studs. Also press out drive hub.

Springs

Replace springs that appear to be stretched or in any way damaged.

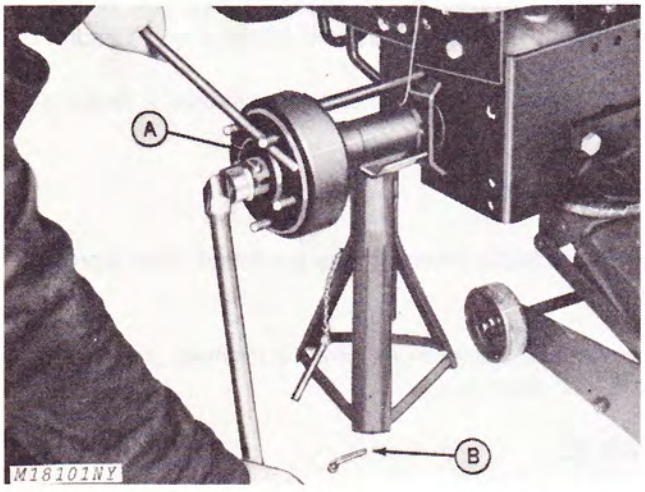
INSTALLING BRAKE SHOES AND DRUM



A—Shoes **C—Springs**
B—Back Plate **D—Springs**

Fig. 15-Installing Hub and Drum

Assemble shoes (A, Fig. 15) and springs (C and D) to back plate (B).



A—Hub **B—Cotter Pin**

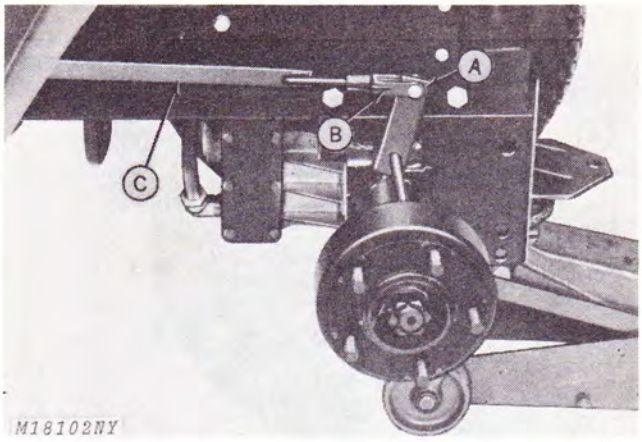
Fig. 16-Tighten Hub to Axle

Slide hub (A, Fig. 16) onto axle. Install washer and castle nut.

IMPORTANT: DO NOT hammer hub onto axle. Bearing damage could result.

Tighten castle nut to 35 to 40 ft-lbs. (47 to 54 Nm) torque. Install cotter pin (B).

BRAKE ADJUSTMENT



A—Pin **C—Brake Link**
B—Yoke

Fig. 17-Adjusting Brake Link

Attach brake pedals together with locking strap. Lower parking brake knob and depress brake pedals until they engage in the second notch of the parking brake latch.

NOTE: Adjust brakes so both rear wheels are locked with pedals in this position.

Remove pin (A, Fig. 17), and turn yoke (B) onto brake link (C) to shorten brake link.

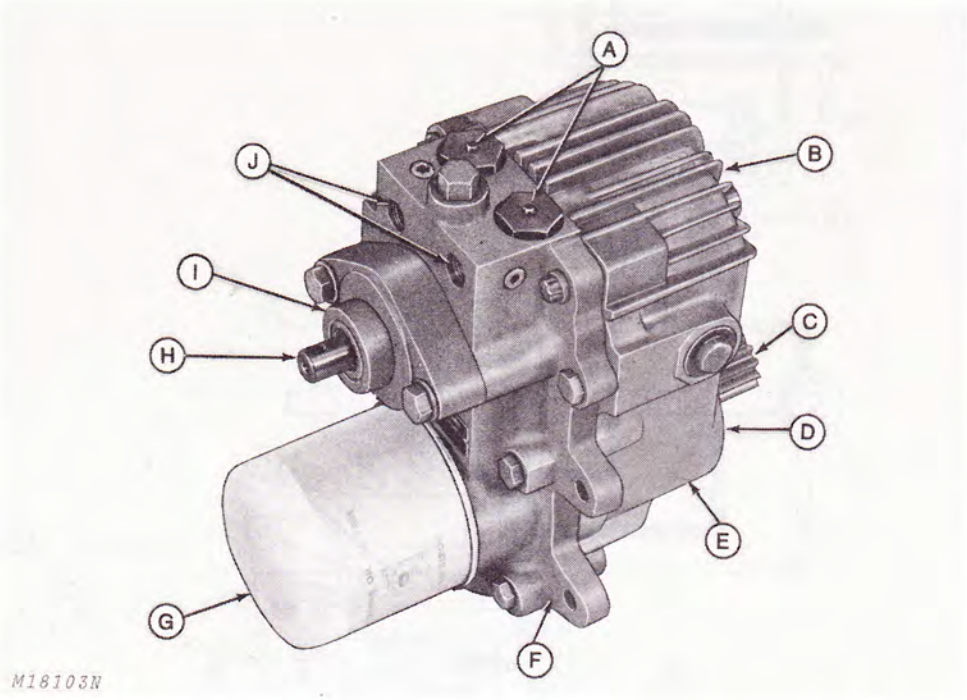
TORQUE SPECIFICATIONS

Brake Back Plate . . . . . 15 ft-lbs (20.325 Nm)

Brake Hub-to-Axle Shaft . . . . . 35-40 ft-lbs (47.42-54.20 Nm)

Group 15
HYDROSTATIC TRANSMISSION

GENERAL INFORMATION



M18103N

A—Check Valves
B—Piston Pump
C—Output Shaft and Gear
D—Piston Motor
E—Rear Housing
F—Front Housing
G—Oil Filter
H—Pump Drive Shaft
I—Charge Pump
J—Hydraulic System Outlets

Fig. 1-Hydrostatic Transmission

The hydrostatic transmission, Fig. 1, is a compact unit which consists of a charge pump, piston pump, piston motor, and valve system.

The charge pump performs three principle functions: First, it supplies oil under low pressure to the hydrostatic piston pump; second, it supplies oil and pressure for the hydraulic lift system; and third, it furnishes oil to make up for internal leakage. It also circulates oil for cooling.

A piston pump driven by the engine delivers oil under high pressure to the piston motor. This high pressure causes the piston motor to rotate, transmitting power to the differential through the output shaft and gear.

Forward or reverse operation of the transmission is controlled by a single lever. This control lever changes the distance the pistons of the piston pump travel, increasing or decreasing transmission output shaft speed.

Reducing the piston travel applies a braking effort to the piston motor which will slow or stop tractor travel.

Any excessive oil pressure which develops from directional changes in the transmission operation is controlled by the check valve system.

Two Basic Principles of Hydraulics

A knowledge of two basic principles of hydraulics is required to understand the hydrostatic system.

1. Liquid has no shape of its own. Therefore, in any hydraulic system, the liquid (oil) may be directed into passages of any size or shape.

2. Liquid is incompressible. Being incompressible, pressure applied to a confined liquid will be transmitted equally in all directions throughout the liquid.

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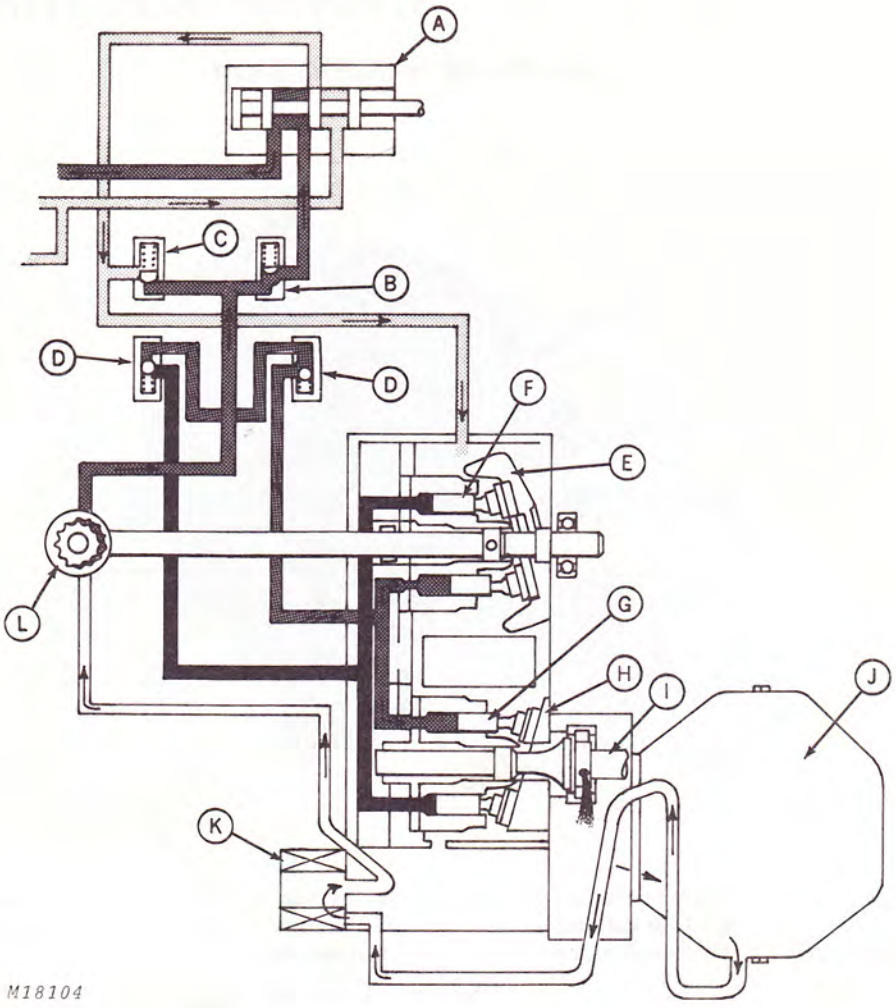
PRINCIPLE OF OPERATION



A—Lift Control Valve
B—Charge Relief Valve
C—Implement Relief Valve
D—Check Valves
E—Variable Swashplate
F—Piston Pump
G—Motor
H—Fixed Swashplate
I—Output Shaft
J—Differential
K—Filter
L—Rotor Charge Pump

Fig. 2-Hydrostatic Oil Flow Diagram

The hydrostatic transmission consists of a charge pump and variable displacement piston pump connected in a closed loop with a fixed displacement piston motor.

The variable displacement pump is driven by the engine drive shaft and the fixed displacement motor is driven by fluid from the pump. The direction of rotation and speed of the motor depends on the amount of flow from the pump.

The flow of the pump is varied when the control lever linked to the swashplate is moved. This changes the angle of the swashplate and thus the stroke of the piston in the pump.

IMPORTANT: To prevent hydrostatic transmission damage during winter weather, run engine until the hydraulic lift system functions before moving hydrostatic control lever from the neutral position.

Extremely cold weather can cause charge pump cavitation for a short period. During this time the slippers and the slipper retainer can be damaged.

A valve system in the transmission front housing contains the implement and charge pump relief valves that relieve hydraulic pressure at pre-set limits within the hydraulic lift and transmission circuits.

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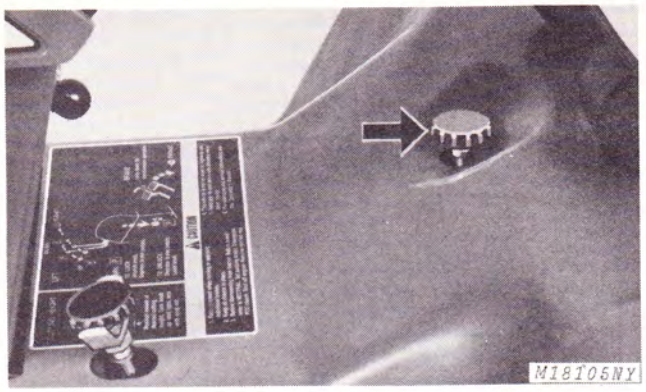

Fig. 3-Free-Wheeling Valve

The two check valves permit pressure to build to workable limits within the system, and provide directional control for oil entering and leaving the piston pump. The two check valves can be opened manually to relieve pressure so the tractor can be pushed by hand for short distances. This is done by turning the free-wheeling valve in all the way, Fig. 3.

The piston motor is an axial piston, fixed displacement motor of the same design as the piston pump. The piston motor drives the output shaft.

As oil pressure from the piston pump enters the motor, force is exerted against the pistons of the motor. The pistons slide on the incline of the fixed swashplate and cause the cylinder block to rotate. As the cylinder block rotates some oil is expelled and returned to the reservoir for re-use and cooling.

The speed the cylinder block rotates is dependent upon the volume of oil being displaced by the piston pump. The greater the variable swashplate angle in the pump, the faster the cylinder block rotates in the motor. Reducing the swashplate angle slows motor rotation, slowing or stopping the tractor.

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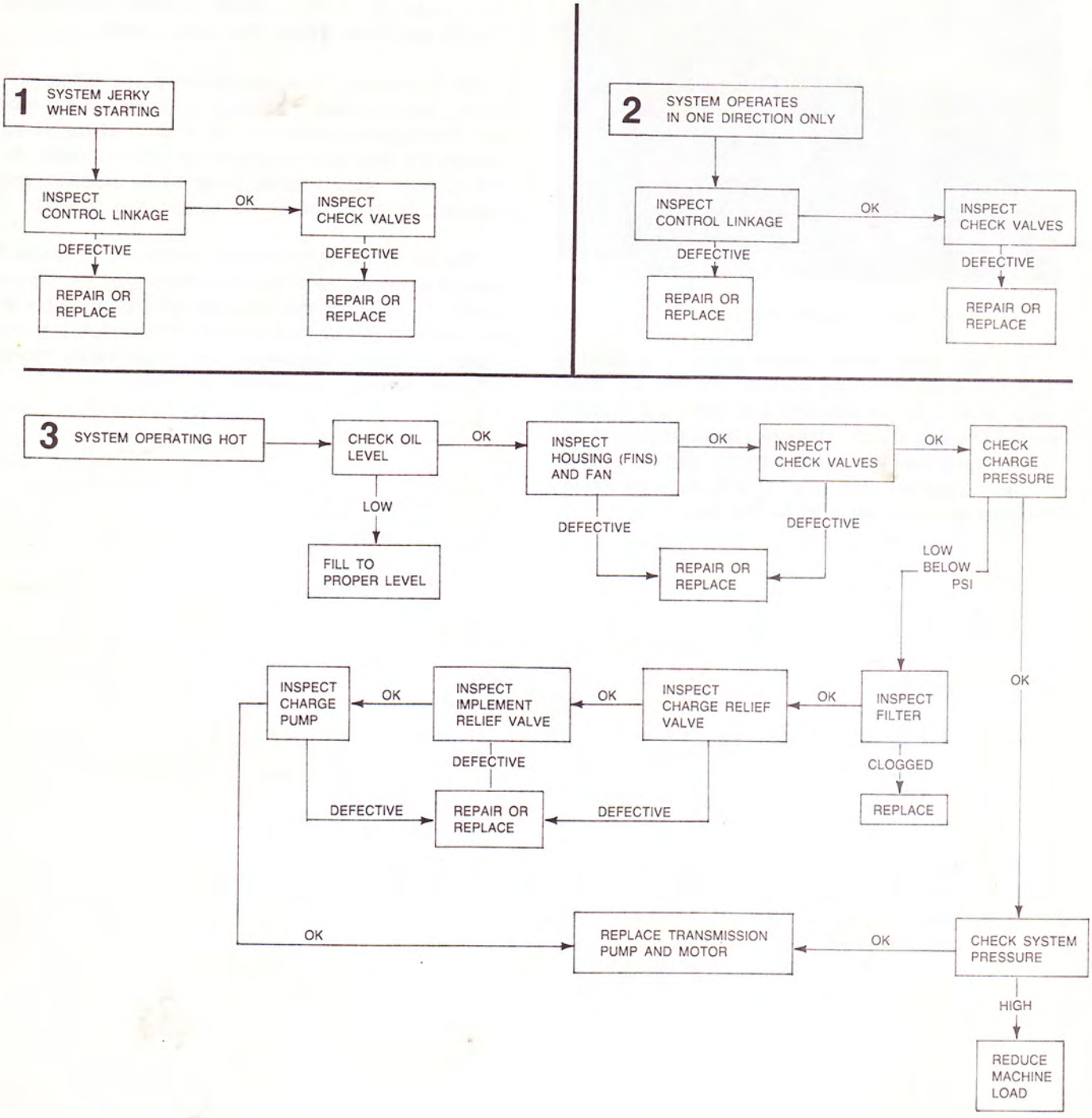
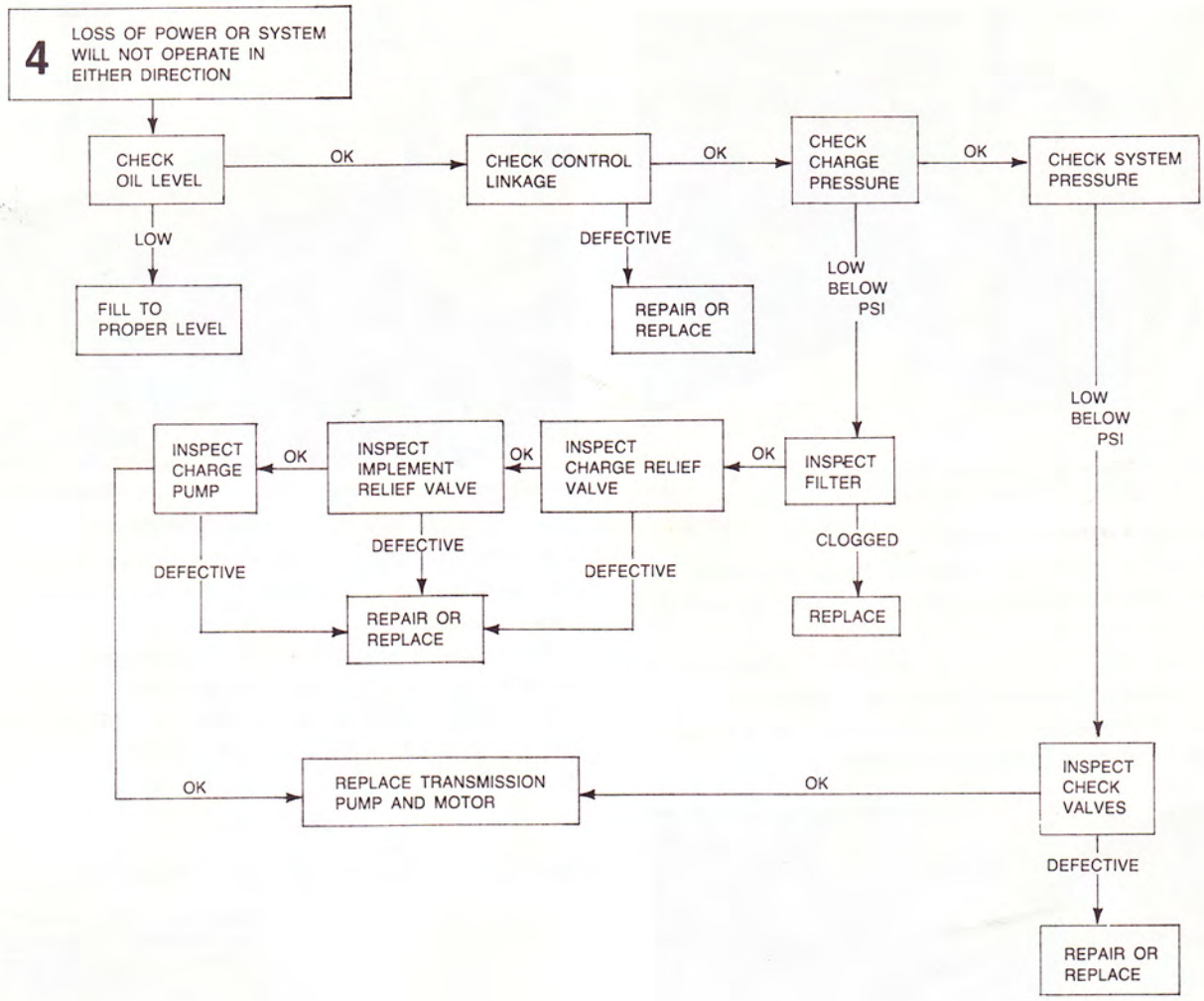
DIAGNOSING MALFUNCTIONS



DIAGNOSING MALFUNCTIONS



TESTING

Implement Circuit Pressure Test

Fig. 4-Checking Implement Circuit Pressure at the Front Couplers

Operate engine at full throttle.

Use a 0 to 1000 psi pressure gauge to check implement circuit pressure at the front hydraulic outlets, Fig. 4.

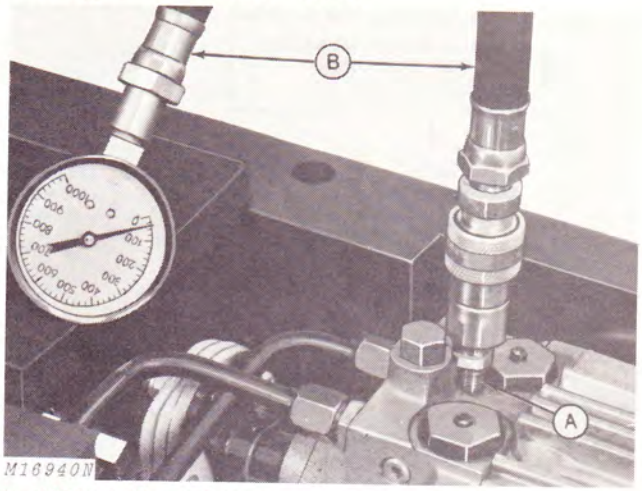
Operate hydraulic lever in direction necessary to obtain reading. Pressure should be between 500 and 600 psi. If pressure is low, check for low transmission oil level or a plugged oil filter.

Fig. 5-Checking Implement Circuit Pressure Ahead of the Implement Control Valve

If pressure remains low at the front couplers, take a pressure reading at the inlet line to the control valve, Fig. 5.

If pressure is between 500 and 600 psi at this point, the control valve must be repaired or replaced. See page 60-15-1. If pressure is still low, remove the fender-deck and make the charge pump pressure test. Also check for excessive internal leakage in the transmission.

Charge Pressure Test



A—1/8-Inch Pipe Adapter **B—Pressure Gauge**

Fig. 6-Checking Charge Pump Pressure

It is necessary to remove the fender-deck to test charge pump pressure. See "Removing Fender-Deck, page 30-20-2.

To check pressure, remove the pipe plug at the top of the transmission. Install pipe adapter (A), Fig. 6, and a 0 to 1000 psi pressure gauge (B). With the engine running at half throttle, pressure should be between 75 to 110 psi.

REPAIR

Removing Transmission from Tractor

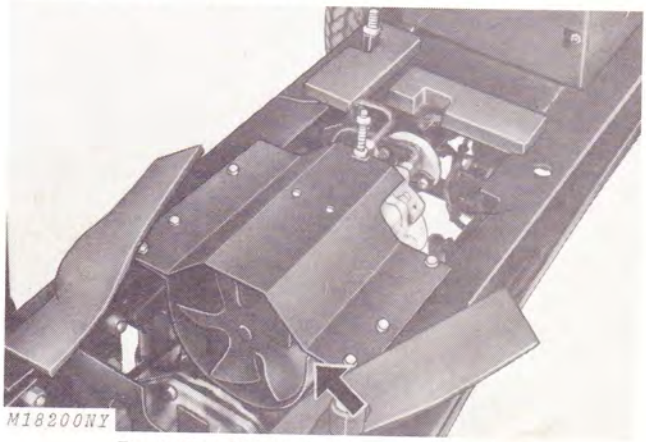


Fig. 7-Fan Shield and Transmission Fan

NOTE: It is not necessary to remove the transmission to service check valves, relief valves, trunnion shaft oil seals, charge pump or rear PTO oil seal. Before removing and disassembling the transmission, read "Diagnosing Malfunctions" in this group.

Remove fender-deck and fuel tank. Wipe dirt and grass from the transmission and the area around it. Remove fan shield and transmission fan.

⚠ CAUTION: Keep hands and tools away from fan when operating tractor with fender-deck removed.

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Making Wood Repair Stand

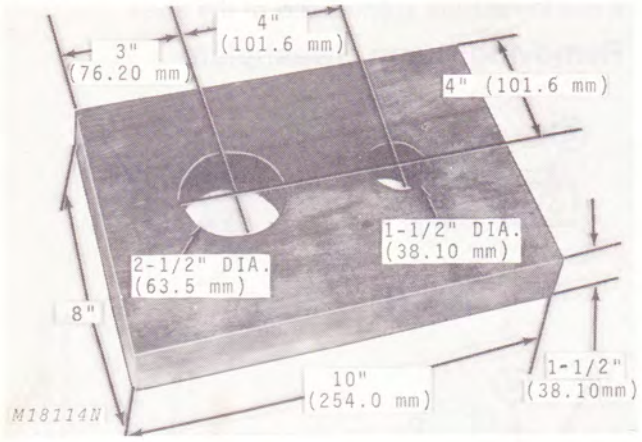


Fig. 13-Wood Repair Stand for Servicing Transmission

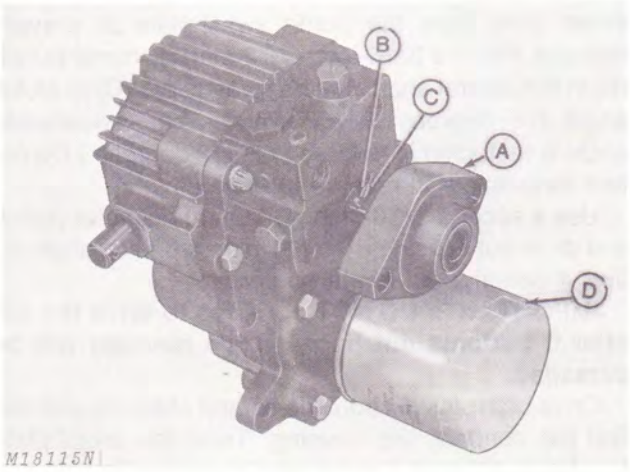
Make a wood fixture as shown in Fig. 13, to facilitate transmission disassembly and assembly.

DISASSEMBLY

Clean the outside of the transmission. Many internal parts have highly polished surfaces. Extreme care must be taken to prevent damage during disassembly and assembly.

To minimize the possiblity of rust, coat your hands with transmission oil before handling polished parts.

Removing Charge Pump

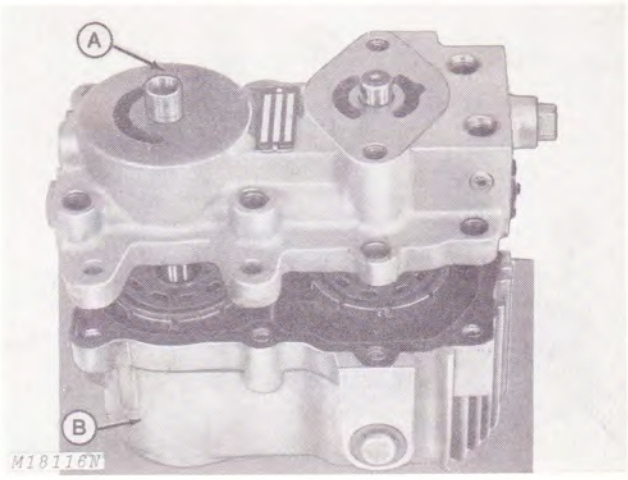


A—Charge Pump **C—Drive Pin**
B—Input Shaft **D—Oil Filter**

Fig. 14-Removing Charge Pump

Remove cap screws securing the charge pump (A), Fig. 14, to the front of the transmission housing. Carefully slide pump assembly off input shaft (B). Remove pump drive pin (C) from input shaft (B). Remove oil filter (D).

Removing Front Housing



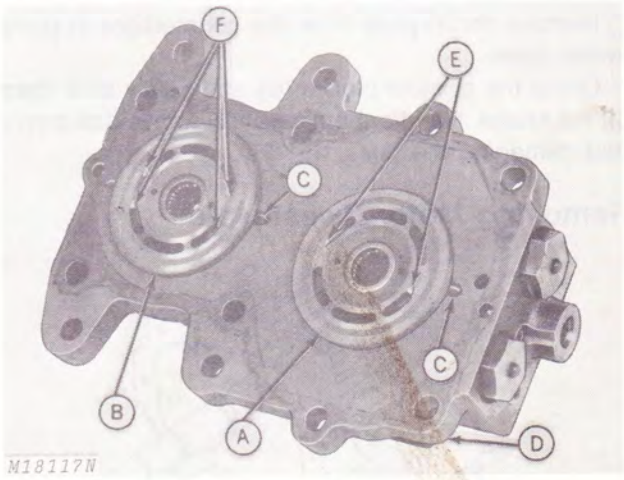
A—Front Housing **B—Rear Housing**

Fig. 15-Removing Front Housing

Remove the eight cap screws, Fig. 15, attaching the front housing (A) to the rear housing (B).

Lift front housing from rear housing, Fig. 15.

Removing Valve Plates



A—Pump Plate **D—Front Housing**
B—Motor Plate **E—Two Notches**
C—Anchor Pin **F—Four Notches**

Fig. 16-Removing Valve Plates

IMPORTANT: The valve plates may stick to the front housing (D). Be extremely careful not to drop them.

Remove the pump and motor valve plates, Fig. 16, noting the location of each plate.

The plate with two relief notches (A) is used on the piston pump assembly, and the plate with four notches (B) is used on the motor assembly.

Remove plate anchor pins (C) to avoid losing or dropping them during service.

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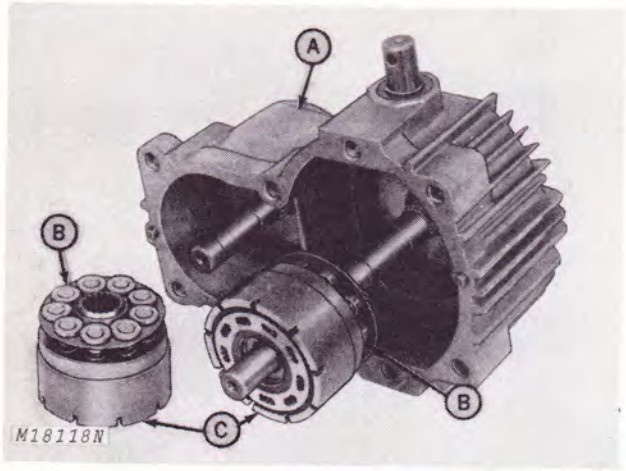
Removing Cylinder Blocks



A—Housing **B—Piston Assemblies** **C—Cylinder Blocks**

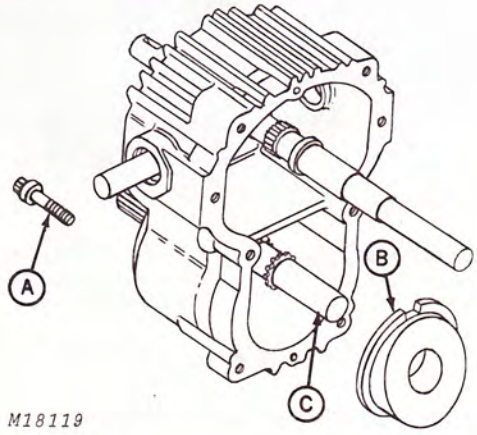
Fig. 17-Removing Cylinder Blocks

Tip the rear transmission housing (A), Fig. 17, when the blocks are being removed to prevent piston assemblies (B) from falling out of the cylinder blocks (C). There is no special orientation of piston-to-bore that needs to be maintained, but parts are not interchangeable between cylinder block assemblies.

Remove thrust plate from the counterbore in pump swash plate.

Grasp the cylinder blocks (C) and gently slide them off the shafts. Handle them carefully to avoid dropping and damaging the units.

Removing Motor Swashplate



A—Cap Screw **B—Swashplate** **C—Motor Shaft**

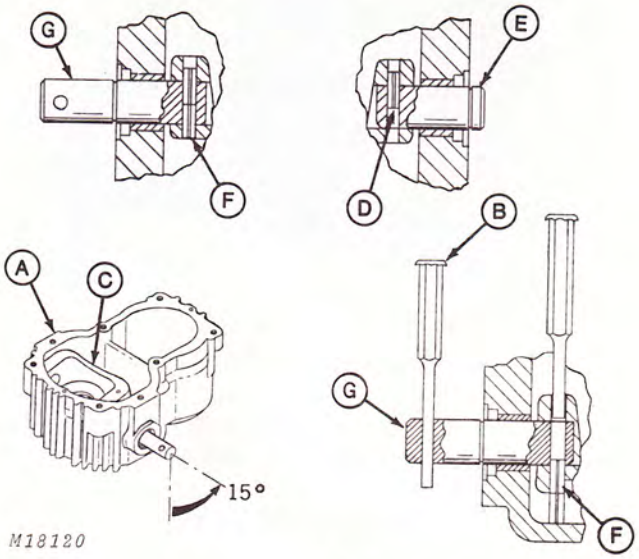
Fig. 18-Removing Motor Swashplate

Remove the two socket-head cap screws (A) retaining the motor swashplate (B), Fig. 18.

Tip housing on its side and remove swashplate (B) and motor shaft (C).

The motor shaft and bearing is removed by pressing it out toward the splined end of the shaft.

Removing Pump Swashplate



A—Housing
B—Punch
C—Swashplate
D—Single Pin
E—Trunnion Shaft
F—Double Pins
G—Control Shaft

Fig. 19-Removing Pump Swashplate

Place the housing (A) with the large cavity up, Fig. 19. Use care not to damage housing. Remove the thrust plate from the pump swashplate to prevent damage. Place a 3/16-inch (4.72 mm) diameter punch (B) in the control shaft. Tilt the swashplate (C) to its full angle (15 degrees fully forward). (The swashplate angle is restricted in reverse to 7-1/2 degrees.) Do not turn swashplate in reverse to drive pins.

Use a second 3/16-inch (4.72 mm) diameter punch and drive out the single pin (D) in the trunnion shaft (E) until it bottoms out in the housing.

IMPORTANT: DO NOT continue to drive the pin after it bottoms out because the housing will be damaged.

Drive both pins (F) from the control shaft (G) until the first pin contacts the housing. Twist the swashplate (control shaft) back toward neutral and the first pin and the pin on the trunnion shaft should fall into the housing.

Tilt the swashplate back to its full angle (15 degrees) and drive the second pin out of the control shaft until it bottoms in the housing. Twist the swashplate back to neutral and the pin should fall into the housing.

IMPORTANT: Note location of swashplate in housing and mark parts accordingly to insure proper assembly.

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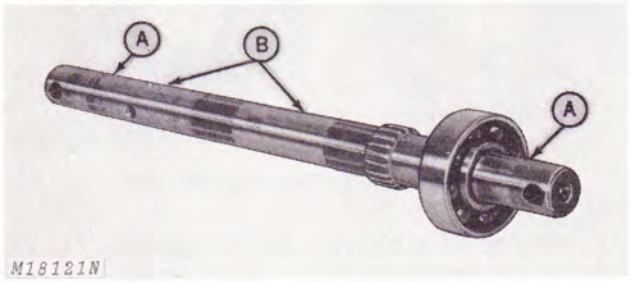
INSPECTION

Pump Shaft



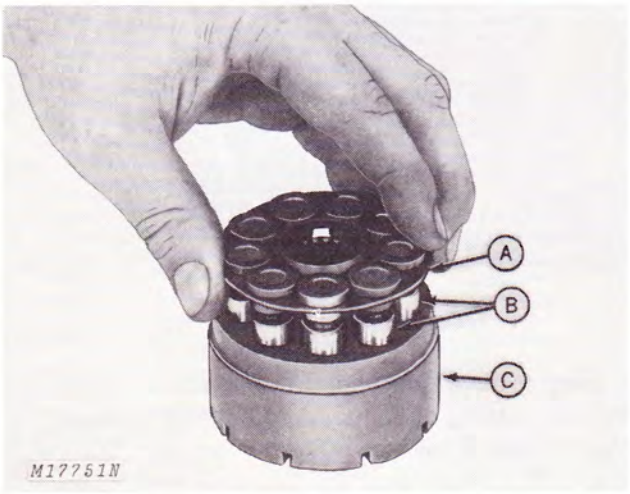
A—Seal Surfaces **B—Bearing Surfaces**

Fig. 20-Inspecting Pump Shaft and Bearing

Remove and inspect pump shaft and bearing assembly, Fig. 20. Replace bearing if it is worn.

Inspect pump shaft bearing and seal surfaces. If shaft is found to be rough or grooved, replace shaft.

Cylinder Block Bore and Pistons



A—Slipper Retainer **B—Pistons** **C—Cylinder Block**

Fig. 21-Inspecting Cylinder Block

Gently lift all pistons (B) as shown in Fig. 21. Check for free movement of pistons in cylinder block bores.

A scored piston or cylinder block bore will require a replacement of the complete assembly.

IMPORTANT: Do not interchange pistons between cylinder blocks (C). Pistons and cylinder blocks are matched.

Slipper Retainer

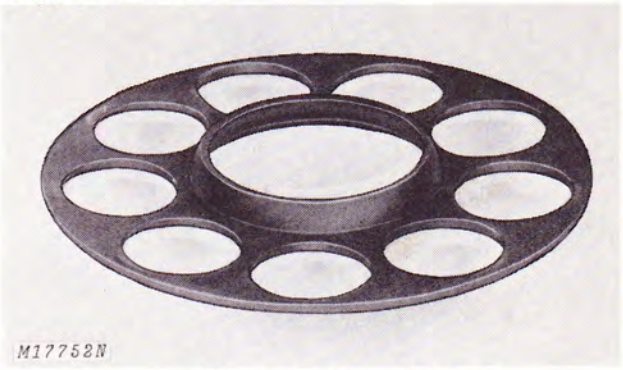


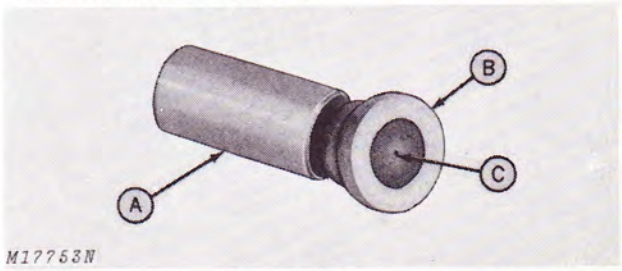
Fig. 22-Inspecting Slipper Retainer

Check slipper retainer, Fig. 22, for flatness. Replace retainer if bent. Reusing a bent retainer can cause pistons to bind, scoring the cylinder block.

If slipper retainer is bent, check for the following possible causes:

1. Charge pump inoperative.
2. Wrong viscosity oil.
3. Oil filter plugged.
4. Air leaking into intake line.

Pistons and Slippers



A—Barrel **B—Slipper** **C—Lube hole**

Fig. 23-Inspecting Piston and Slippers

If pistons have scored barrels or slippers have edges rounded more than 1/32 inch (0.794 mm), replace the entire cylinder block assembly.

Inspect lubricant hole for blockage. If blocked, open hole with compressed air, Fig. 23.

Individual pistons and cylinder blocks are not available for service because of the close tolerance-match fitting required for proper operation. A new cylinder block assembly complete with pistons must be installed.

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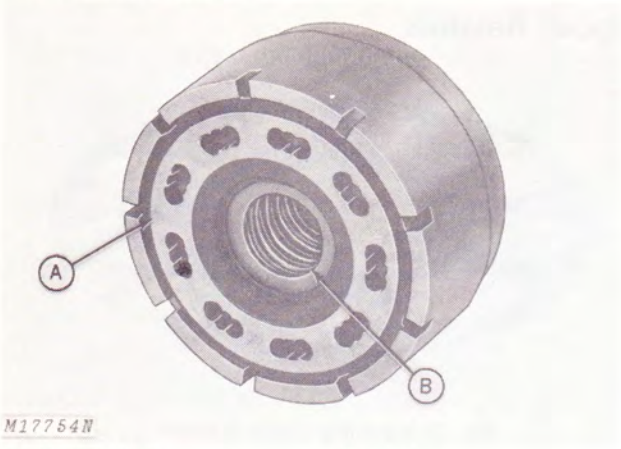
Cylinder Block Face



A—Polished Face **B—Spring**

Fig. 24-Inspecting Cylinder Block Face

Inspect polished face (A) of cylinder block, Fig. 24, for scoring. Replace cylinder block assembly if scored.

Check spring (B) for breakage. If broken, replace cylinder block assembly.

Valve Plates

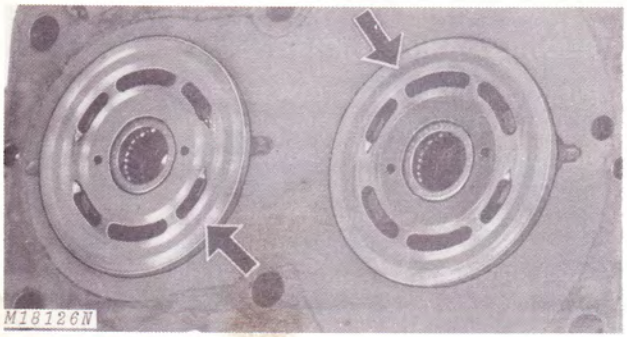


Fig. 25-Inspecting Valve Plates

Thoroughly clean valve plates, Fig. 25, and dry them with compressed air.

Inspect valve plates for scratches, excessive wear or erosion. A worn or scored valve plate reduces pump efficiency.

NOTE: To check valve plates for wear, run your finger nail across face of plate. If wear is felt, replace the plate.

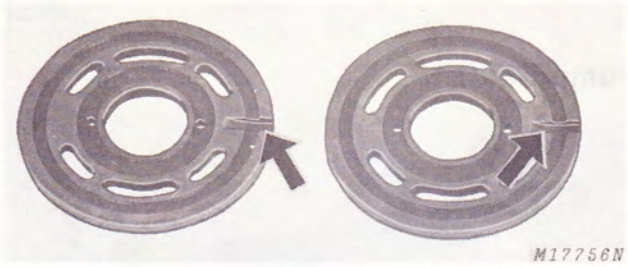


Fig. 26-Inspecting Valve Plate Pin Slots

Inspect the valve plate pin slot and grooves, Fig. 26. Remove any foreign material and deburr the surface if necessary.

Swashplates

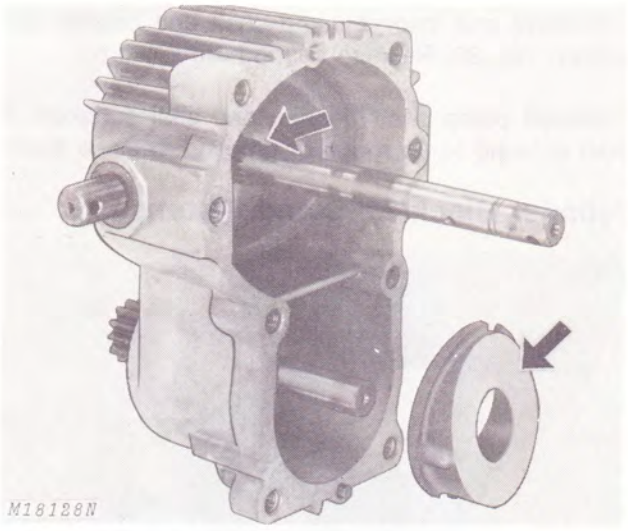


Fig. 27-Inspecting Swashplates

Inspect pump and motor swashplates, Fig. 27, for wear or scoring of the polished bearing surfaces. Replace plates if worn or scored.

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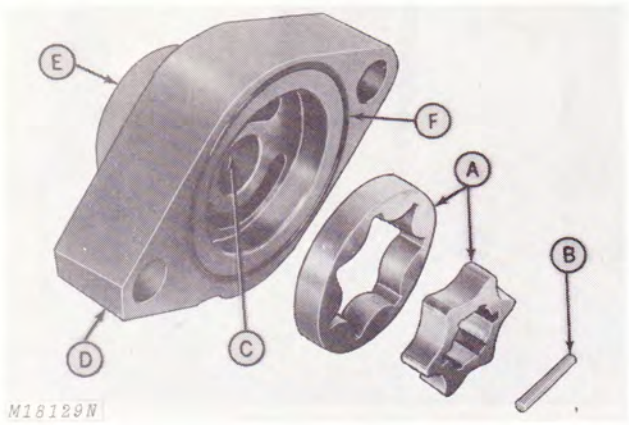
Charge Pump



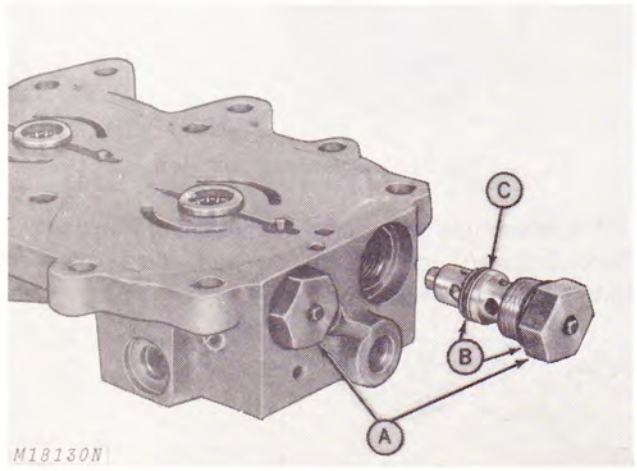
A—Gerotor Set
B—Drive Pin
C—Needle Bearing
D—Pump Housing
E—Seal
F—O-Ring Seal

Fig. 28-Inspecting Charge Pump

Inspect gerotor set (A), pump housing (D), and needle bearing (C), Fig. 28, for wear or damage. Replace entire charge pump if wear or damage is evident.

Always replace O-ring (F) and pump seal (E) before reassembling charge pump to transmission.

Check Valves



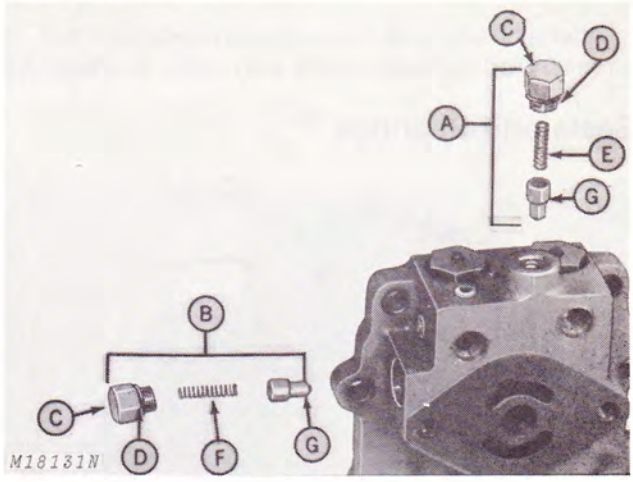
A—Check Valves
B—O-Ring
C—Back-up Rings

Fig. 29-Inspecting Check Valves

Remove and inspect both check valves (A) for free movement of check ball, Fig. 29.

Use new O-rings (B) when reinstalling check valves. Note position of white back-up ring (C) in lower O-ring groove. Replace this ring if it is damaged.

Relief Valves



A—Implement Relief Valve
B—Charge Pump Relief Valve
C—Cap
D—O-Ring
E—Heavy Spring
F—Light Spring
G—Cone

Fig. 30-Inspecting Relief Valves

Remove and inspect implement and charge pump relief valve cones (G) and springs, (E and F), Fig. 30.

Check springs for rust and pitting. Inspect cone points for wear. Replace springs and cones if worn, pitted, or rusted.

Housing Bearings

Inspect housing bearings for wear and loose bearing rollers. Replace any questionable bearings.

Housing Seals

To prevent costly rework, install new seals when assembling the transmission.

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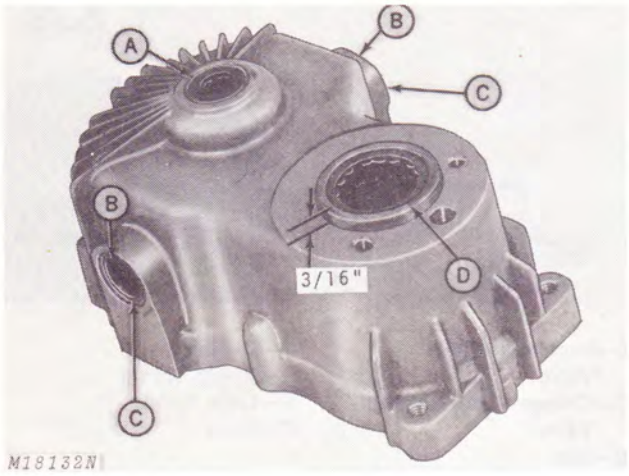
ASSEMBLY

After all parts have been cleaned and inspected, oil all machined surfaces lightly with clean hydraulic oil.

Seals and Bearings



A—Input Shaft Seal
B—Trunnion Shaft Needle Bearings
C—Trunnion Shaft Seals
D—Output Shaft Bearing

Fig. 31-Installing Seals and Bearings

Press the trunnion shaft needle bearings (B), Fig. 31, into the housing from the outside until they bottom in the bore.

Start trunnion shaft seals (C), Fig. 31, by hand. Then drive seals in with a seal driver or pipe of the same diameter until they bottom against needle bearings.

When installing a new output shaft bearing (D), Fig. 31, press bearing into housing until 3/16 inch (0.188 mm) of the outer race remains extended above mounting flange.

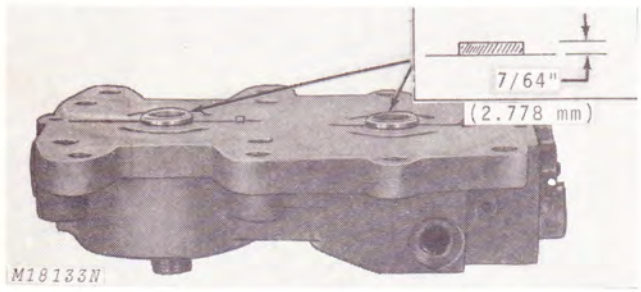
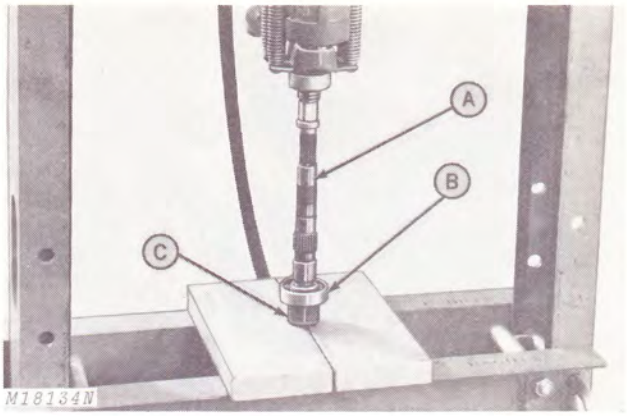


Fig. 32-Installing Front Housing Bearings

Install front housing bearings, Fig. 32, so that 3/32 to 1/8 inch (2.381 to 3.175 mm) of the bearing remains above the machined surface. This is important because these two bearings pilot the valve plates when the unit is assembled.



A—Input Shaft **B—Bearing** **C—Pipe**

Fig. 33-Installing Input Shaft Bearing

Press bearing (B) onto input shaft (A) by pressing on inner race only. Lubricate and place shaft and bearing assembly into rear housing.

Variable Swashplate

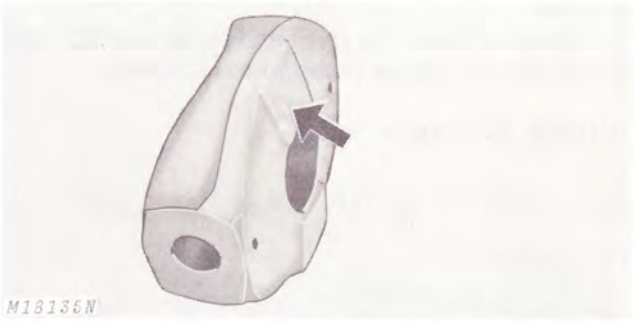


Fig. 34-Variable Swashplate Pads

Place variable swashplate into housing with thin pad (arrow) toward top of housing and counterbore for thrust plate up. Refer to Fig. 34.

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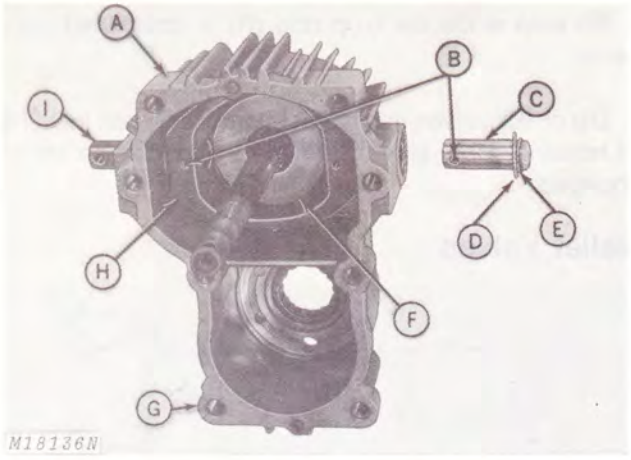
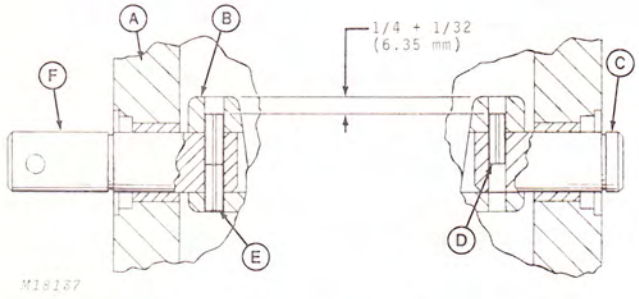


A—Housing Top
B—Spring Pins
C—Trunnion Shaft
D—Washer
E—Snap Ring
F—Thrust Plate
G—Rear Housing
H—Variable Swashplate
I —Control Trunnion Shaft

Fig. 35-Installing Trunnion Shafts

Position trunnion shafts into housing and align spring pin holes in swashplate and shaft to facilitate installation of spring pins.



A—Housing
B—Swashplate
C—Trunnion Shaft
D—Single Pin
E—Double Pin
F—Control Shaft

Fig. 36-Installing Spring Pins

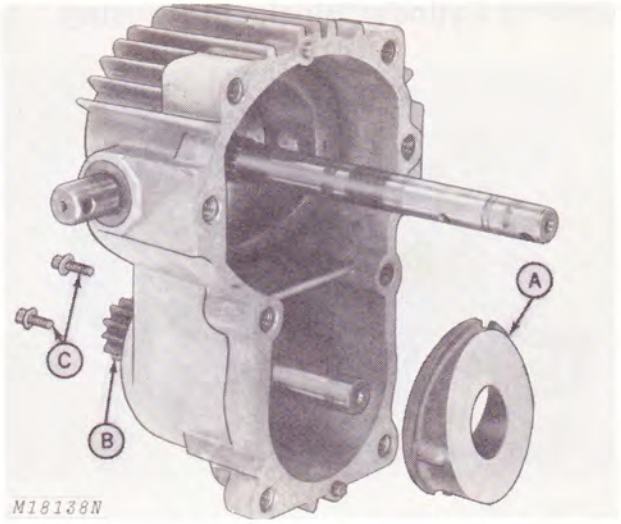
Install two pins in control shaft. Drive first pin until second pin can be started; then, drive both pins in until the last pin is approximately 1/4-inch (6.350 mm) below swashplate.

Install one pin in the trunnion shaft, driving it in until it is approximately 1/4 inch below the swashplate.

The swashplate should swing freely in the pump housing.

Place the thrust plate (F) Fig. 35, into machined recess of the swashplate

Motor Swashplate

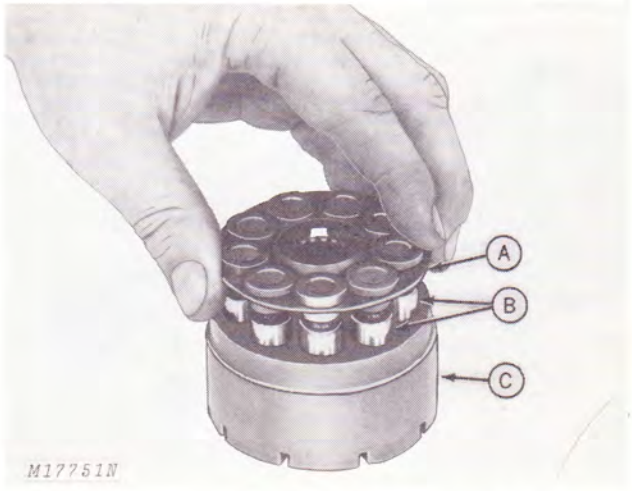


A—Motor Swashplate
B—Output Shaft
C—Socket-Head Screws

Fig. 37-Installing Motor Swashplate

Place output shaft (B) into housing and insert motor swashplate (A), Fig. 37, with thin edge toward center of housing. Secure plate with two socket-head screws (C) Fig. 37. Tighten screws to 100 in-lbs (11.30 Nm) torque.

Cylinder Block and Pistons



A—Slipper Retainer
B—Pistons
C—Cylinder Block

Fig. 38-Cylinder Block Assembly

Assemble cylinder block parts if necessary and lubricate them with clean hydraulic oil. There is no special orientation of piston-to-bore that needs to be maintained. Be sure each piston moves freely in its bore.

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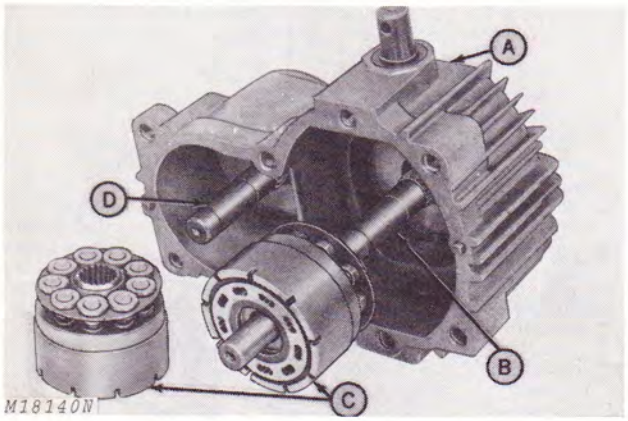
IMPORTANT: DO NOT interchange pistons between cylinder blocks. Pistons and cylinder blocks are matched.

Installing Cylinder Blocks in Housing



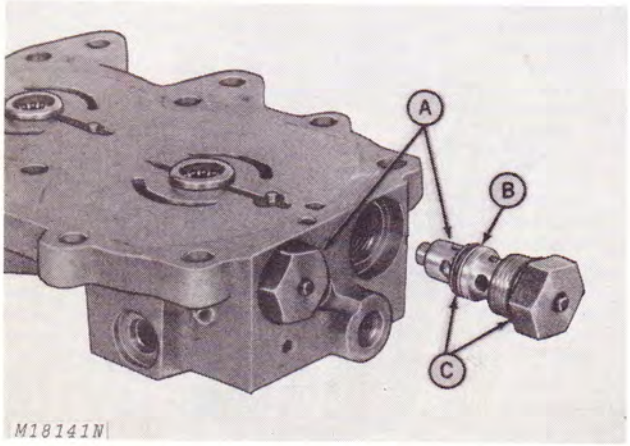
A—Rear Housing
B—Input Shaft
C—Cylinder Blocks
D—Output Shaft

Fig. 39-Installing Cylinder Blocks

Place the housing assembly in a horizontal position. Slide cylinder block assemblies (C) over shaft and engage spline. Be certain that pistons and thrust plate remain in place. When properly installed, spring tension can be felt when pushing on cylinder block.

Lubricate exposed face of cylinder block with clean hydraulic oil.

Check Valves



A—Check Valves **B—White Back-Up Ring** **C—O-Ring**

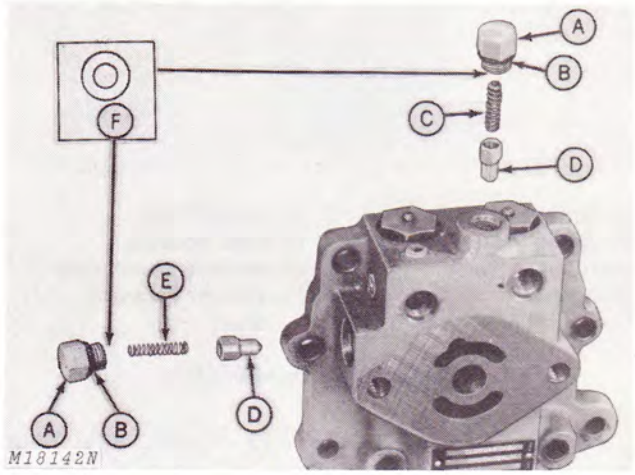
Fig. 40-Installing Check Valves

Replace O-rings (C) on check valves (A), Fig. 40.

Be sure white back-up ring (B) is positioned correctly.

Dip check valves into clean hydraulic oil and install it in housing. Both valves are alike and can be interchanged.

Relief Valves



A—Cap
B—O-Ring
C—Heavy Spring
D—Cone
E—Light Spring
F—Shim

Fig. 41-Installing Relief Valve

Assemble relief valves in front housing by inserting cones (D), springs and caps (A) as shown in Fig. 41. Insert the heavier spring (C) into the implement circuit located at the top of the front housing.

The light spring goes into the charge pump relief circuit, located at the side of the front housing.

Place new O-rings (B) on caps (A), Fig. 41, and install caps firmly.

Shim kits are available to increase relief spring tension if pressure testing indicates low readings. See "Testing", page 50-15-6.

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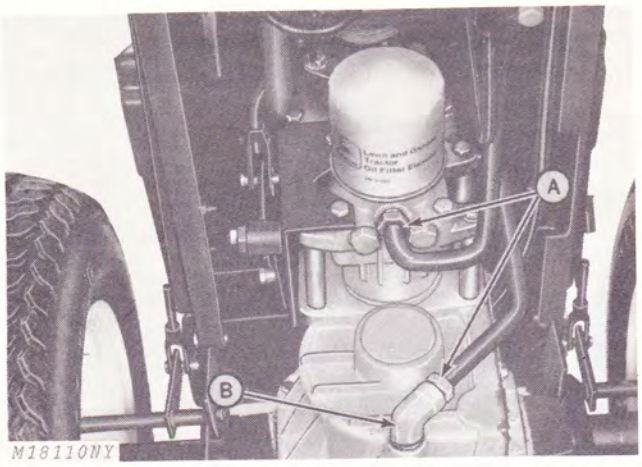
Draining Transaxle



A—Transmission-to-Axle Cooling **B—Fitting**

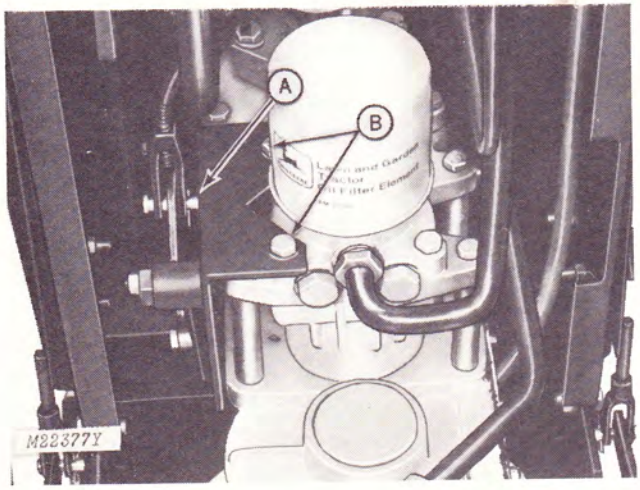
Fig. 8-Draining Transmission Fluid

Remove transmission-to-axle cooling tube (A), Fig. 8, and drain fluid into a container.

NOTE: Early model 300 Tractors were equipped with fitting (B). On these tractors, turn fitting (B) counterclockwise downward to let all fluid drain into container.

Remove the fender-deck and fuel tank as explained on page 30-20-2.

Disconnecting Transmission



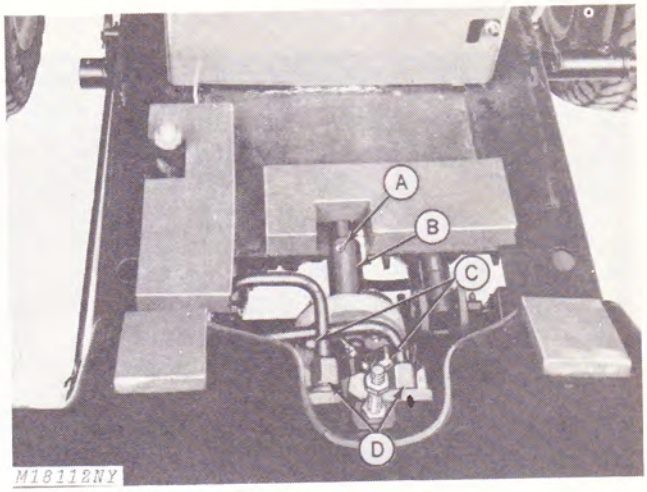
A—Drilled Pin **B—Bolts**

Fig. 9-Disconnecting Transmission

Disconnect control linkage by removing cotter pin and drilled pin (A), Fig. 9. Remove cam arm by removing bolts (B).

Removing Drive Shaft and Hydraulic Lines

300 Tractors (Serial No. 30,001-70,000)



A—Pin **C—Bolts**
B—Yoke **D—Couplings**

Fig. 10-Disconnect Drive Shaft and Hydraulic Lines

Disconnect drive shaft by driving pin (A) from hub (B) and removing bolts (C) at the flexible coupling.

Disconnect hydraulic lines from the front of the hydrostatic transmission at couplings (D) as shown in Fig. 10.

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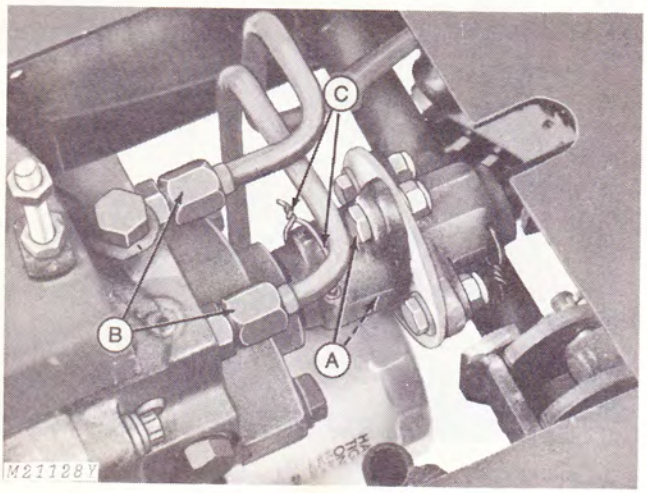
Removing Drive Shaft and Hydraulic Lines

300 Tractor (Serial No. 70,001-80,000) 312, 314 and 316 Tractors



A—Bolts
B—Couplings
C—Pin

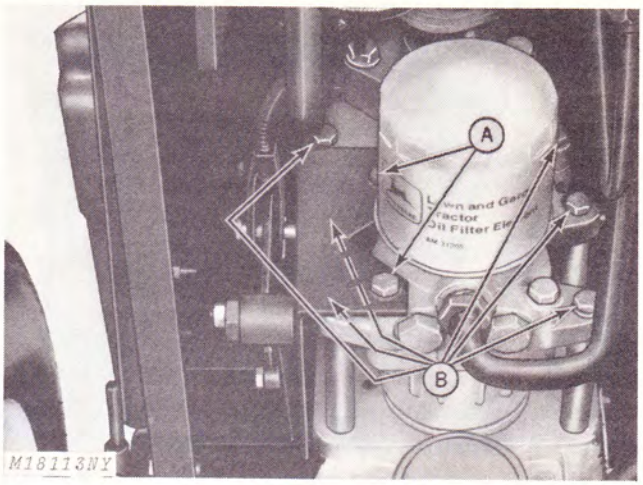
Fig. 11-Disconnect Drive Shaft and Hydraulic Lines

Disconnect drive shaft by removing two bolts (A), Fig. 11, from drive shaft coupling.

Disconnect hydraulic lines from the front of the hydrostatic transmission at couplings (B).

Remove spring pin (C) by cutting wire and driving pin out of shaft.

Removing Transmission



A—Cam and Roller Arm Mounting Bolts
B—Transmission Mounting Bolts

Fig. 12-Removing Hydrostatic Transmission

Remove the mounting bolts holding the cam and roller arm (A) to the hydrostatic transmission, to gain access to the transmission mounting bolts (B), Fig. 12.

Remove the six mounting bolts (B) from hydrostatic transmission and remove the transmission out through the bottom of the frame.

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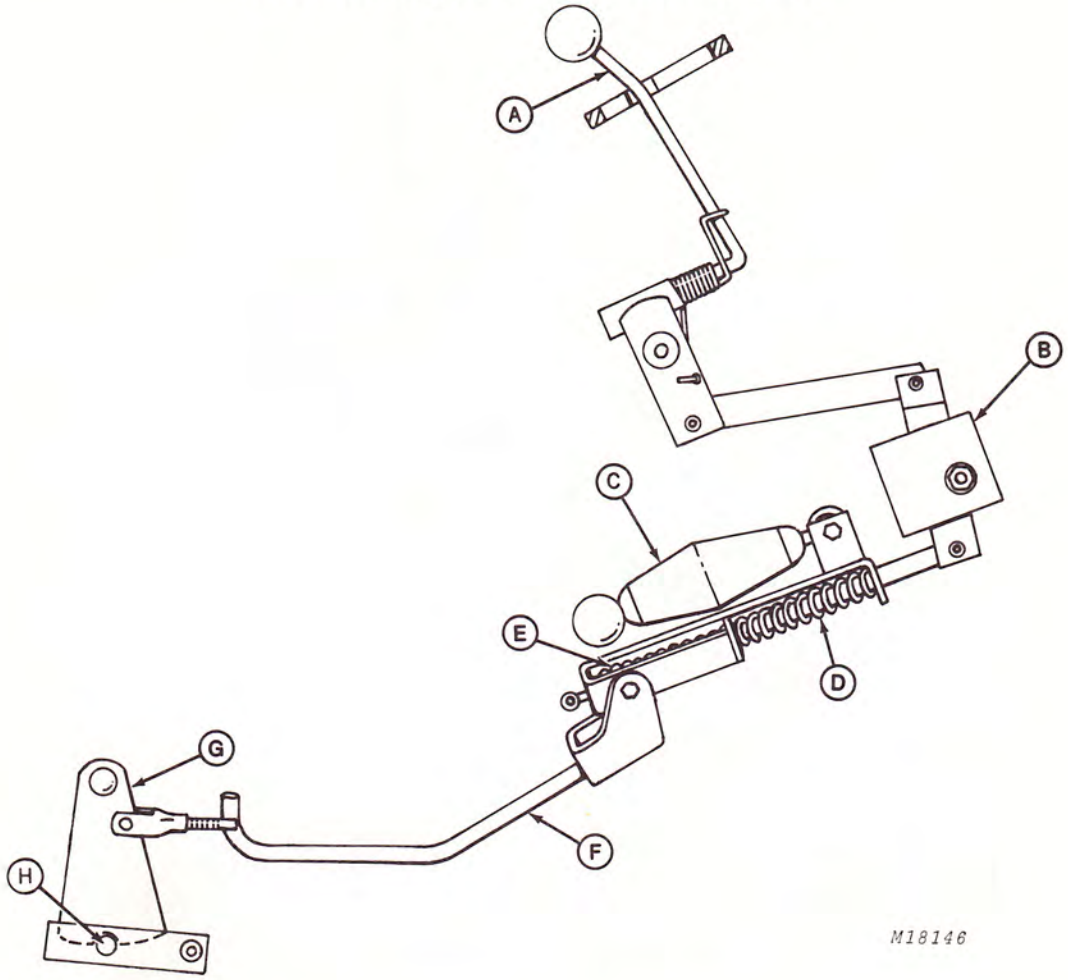
Group 20
HYDROSTATIC CONTROL LINKAGE

PRINCIPLE OF OPERATION

300 Tractor (Serial No. 30,001-55,000)



A—Control Lever
B—Brake
C—Shock Absorber
D—Spring
E—Spring
F—Link
G—Control Arm
H—Roller

Fig. 1-Control Linkage Components

The 300 Tractor hydrostatic control linkage, (Serial No. 30,001-55,000), Fig. 1, is designed to provide smooth shifting of the transmission.

The shock absorber (C) dampens the movement of the linkage in either direction.

Spring (E) compresses when the control lever (A) is moved forward. As the spring tension overcomes the shock absorber (C), it forces the link (F) forward.

Spring (D) compresses when the control lever (A) is moved rearward. As the spring tension overcomes the shock absorber, it forces the link (F) rearward.

The link (F) moves the control arm (G). When the control arm (G) is in neutral position, the roller (H) seats in a detent in the control arm for a positive neutral position.

The brake (B) prevents the linkage from self-movement.

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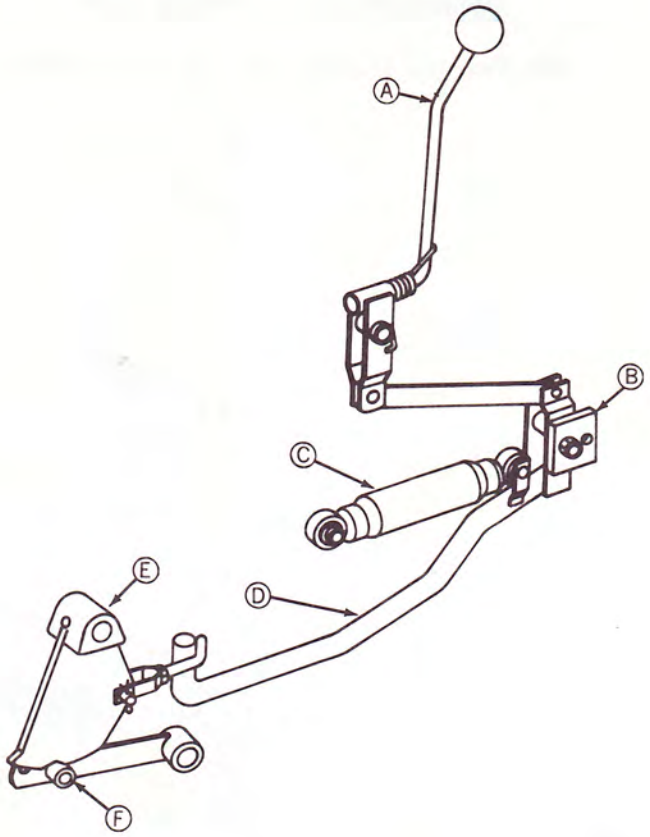
PRINCIPLE OF OPERATION—Continued
300 Tractor (Serial No. 55,001-80,000) 312, 314 and 316 Tractors



A—Control Lever
B—Brake
C—Shock Absorber
D—Link
E—Control Arm
F—Roller

Fig. 2-Control Linkage Components

The 300 Tractor (Serial No. 55,001-80,000), and 312 and 316 Tractor hydrostatic control linkage Fig. 2, is designed to provide smooth and positive shifting of the transmission.

NOTE: 314 Tractors are equipped with a built-in interlock which prevents the control lever (A) from being moved out of "N" neutral position when parking brake is on.

The shock absorber (C) dampens the movement of the linkage in either direction which provides for smooth shifting.

The link (D) moves the control arm (E). When the control arm (E) is in neutral position, the roller (F) seats in a detent in the control arm for a positive neutral position.

The brake (B) prevents the linkage from self-movement.

NOTE: A conversion kit is available for updating 300 Tractor below Serial No. 55,001 to control linkage illustrated in Fig. 2 above.

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REMOVAL

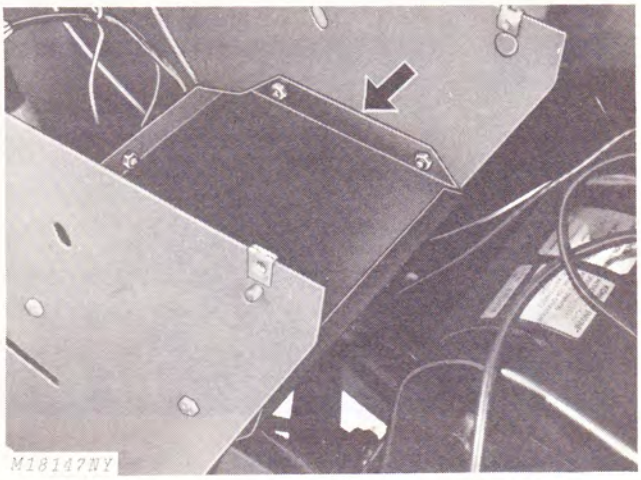

Fig. 3-Removing Side Panels, Battery and Battery Base

On 300 and 316 Tractors and 314 Tractors above Serial No. 120,000, remove the right-hand engine side panel.

Remove the battery as shown on page 40-10-11.

Remove five nuts and bolts holding battery base and remove the base, Fig. 3.

Removing Control Lever

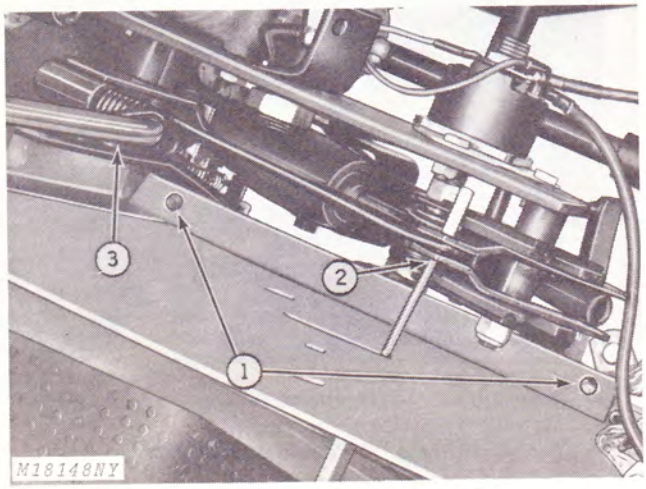

Fig. 4-Removing Control Lever

1. Remove the two cap screws and nuts from the right-hand pedestal side, Fig. 4.
2. Insert punch through slot in pedestal side and drive pin from the control lever link.
3. Remove retaining ring from the control lever shaft and slide the control lever off the shaft.

Remove the knob (not illustrated); then remove the control lever assembly from the tractor.

Removing Shock Absorber

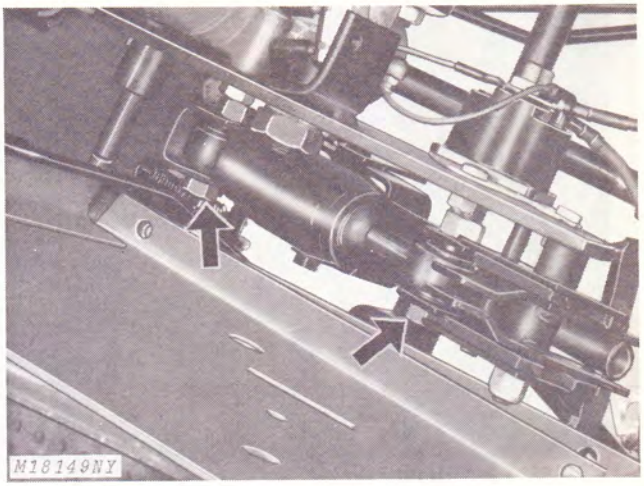

Fig. 5-Removing Shock Absorber

Remove the two bolts and lock nuts from each end of the shock absorber and remove from tractor.

Removing Linkage Brake

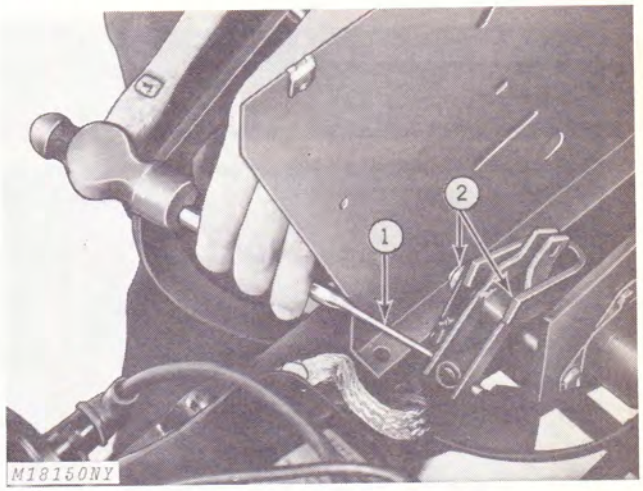

Fig. 6-Removing Brake Assembly

1. Pull the pedestal side out slightly and drive pin from yoke and control arm.
2. Remove the nut from the brake mounting shaft and slide brake pads and yoke off shaft.

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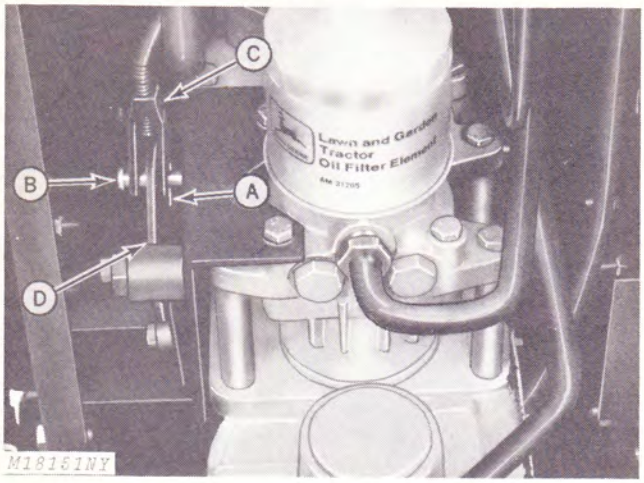
Removing Slide Assembly

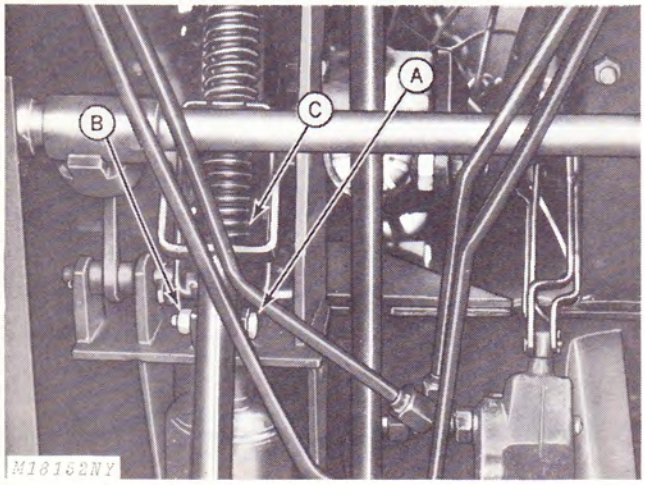
300 Tractors Serial No. 30001-55000



A—Cotter Pin **C—Yoke**
B—Drilled Pin **D—Control Arm**

Fig. 7-Disconnecting Linkage at Control Arm

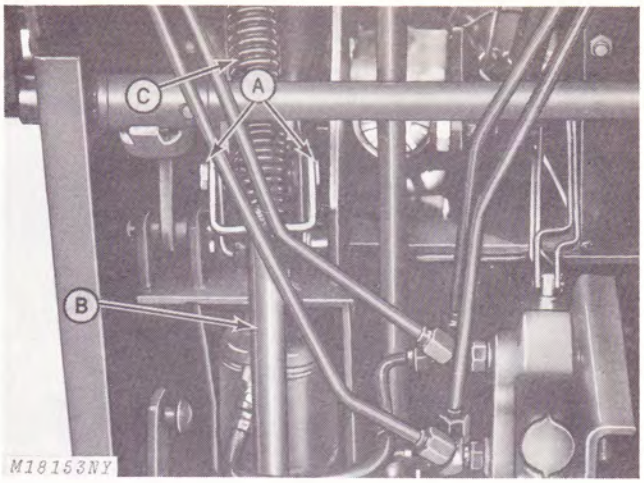
Remove cotter pin (A) and drilled pin (B) from the yoke (C) at the control arm (D).



A—Bolt **B—Lock Nut** **C—Slide Assembly**

Fig. 8-Removing Lower Mounting Bolt from Slide Assembly

Remove bolt (A) and lock nut (B) from slide assembly (C), Fig. 8.

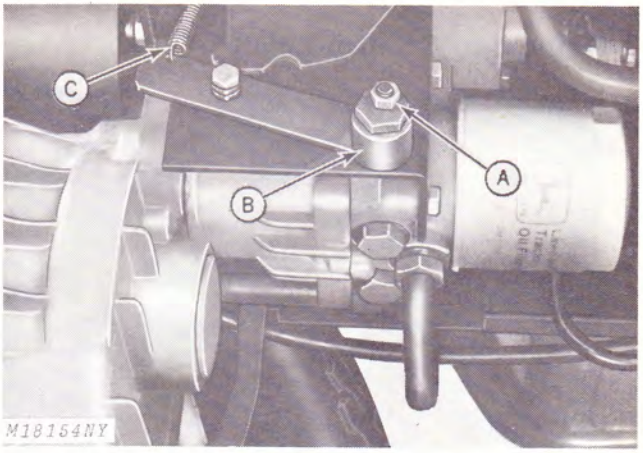


A—Shoulder Bolts **B—Linkage** **C—Slide Assembly**

Fig. 9-Removing Linkage from Slide Assembly

Remove two shoulder bolts (A) connecting the linkage (B) to slide assembly (C), Fig. 9.

Remove the slide assembly through the bottom of the tractor.



A—Nut **B—Roller Arm** **C—Spring**

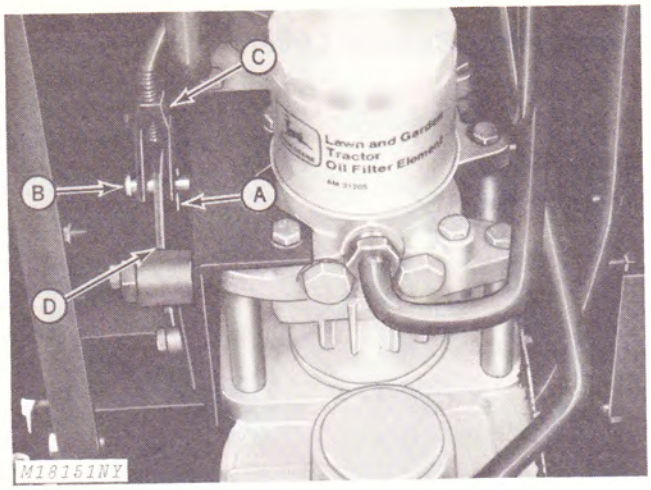
Fig. 10-Removing Roller Arm

Remove the nut (A) from the roller arm pivot shaft and slide the roller arm (B) off the shaft.

Disconnect the spring (C) from the roller arm and from the cotter pin at the mounting bracket.

Removing Link and Control Arm Assembly

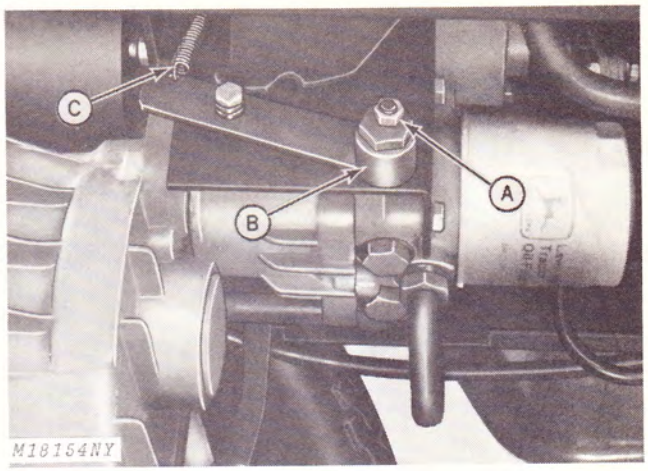
300 Tractor (Serial No. 55,001-80,000) 312, 314 and 316 Tractors



A—Cotter Pin
B—Drilled Pin
C—Yoke
D—Control Arm

Fig. 11-Disconnecting Linkage at Control Arm

Remove cotter pin (A) and drilled pin (B) from the yoke (C) at the control arm (D).



A—Nut **B—Roller Arm** **C—Spring**

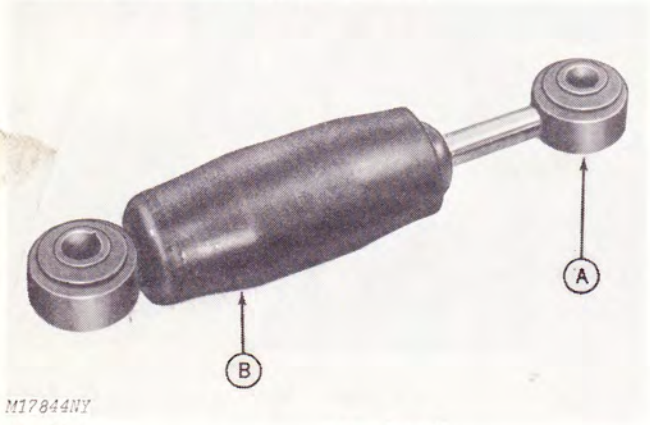
Fig. 12-Removing Roller Arm

Remove the nut (A) from the roller arm pivot shaft and slide the roller arm (B) off the shaft.

Disconnect the spring (C) from the roller arm and from the cotter pin at the mounting bracket.

INSPECTION AND REPAIR

Inspecting Shock Absorber

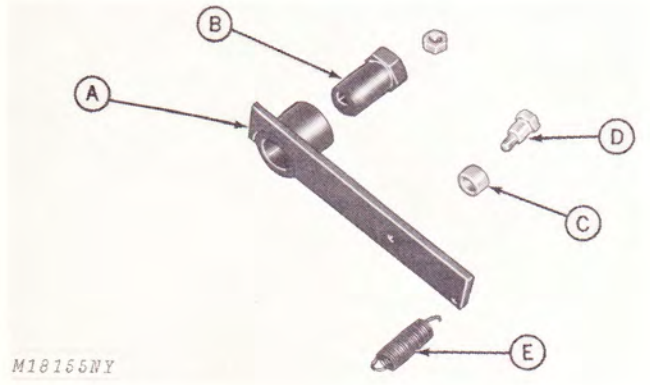


A—Rod **B—Barrel**

Fig. 13-Inspecting Shock Absorber

Hold barrel (B) and move rod (A) in and out. Rod should move under pressure. Check that shock absorber does not leak, Fig. 13.

Inspecting Roller Arm



A—Roller **D—Shoulder Bolt**
B—Eccentric **E—Spring**
C—Roller

Fig. 14-Inspecting Roller Arm

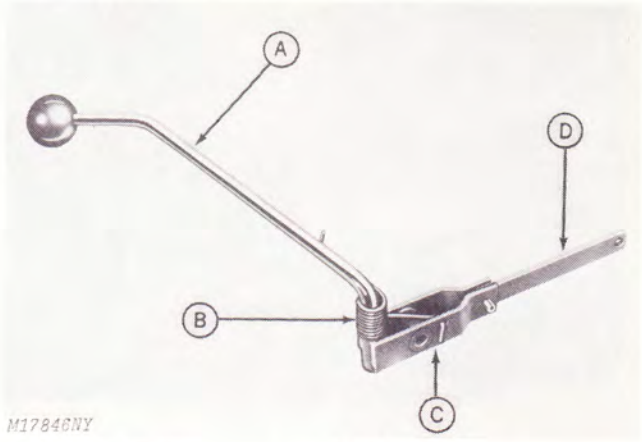
Inspect roller arm (A) for being bent or damaged, Fig. 14.

Check that eccentric (B) turns freely in roller arm (A).

Inspect spring (E) for damage.

Make sure roller (C) does not have flat spots and turns freely on shoulder bolt (D), Fig. 14. Clean parts and replace them if necessary.

Inspecting Control Lever



A—Control Lever **C—Crank**
B—Spring **D—Link**

Fig. 15-Inspecting Control Lever

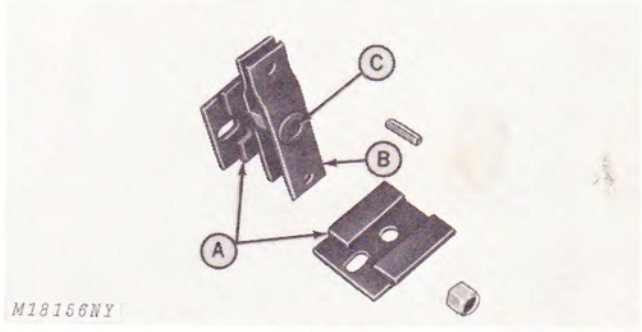
Inspect control lever (A), crank (C) and link (D) for damage, Fig. 15.

Inspect bearing surface in crank (C) for wear or damage.

Check that spring (B) is not broken.

Replace parts if necessary.

Inspecting Control Lever Brake



A—Brake **B—Yoke** **C—Pivot**

Fig. 16-Inspecting Control Lever Brake

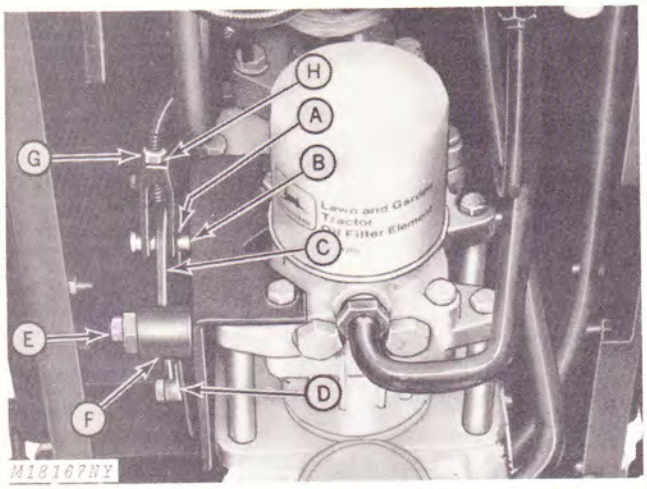
Inspect control lever brake (A) for wear.

Inspect yoke (B) and bearing in pivot (C) for wear or damage.

Replace parts if necessary.

ADJUSTMENTS

Adjusting Hydrostatic Control Linkage



A—Cotter Pin
B—Drilled Pin
C—Control Arm
D—Roller
E—Lock Nut
F—Eccentric
G—Jam Nut
H—Clevis

Fig. 32-Adjusting Hydrostatic Linkage

Block one wheel off ground.

Remove cotter pin (A) and drilled pin (B) from clevis (H).

NOTE: Be sure control lever on dash is in neutral position "N."

Move control arm (C) until the roller (D) will seat in the control arm detent.

Start engine.

CAUTION: Be careful of rotating fan at the rear of the transmission.

Loosen lock nut (E). Turn eccentric until raised wheel stops moving. This means the transmission is fully in neutral.

Tighten lock nut (E).

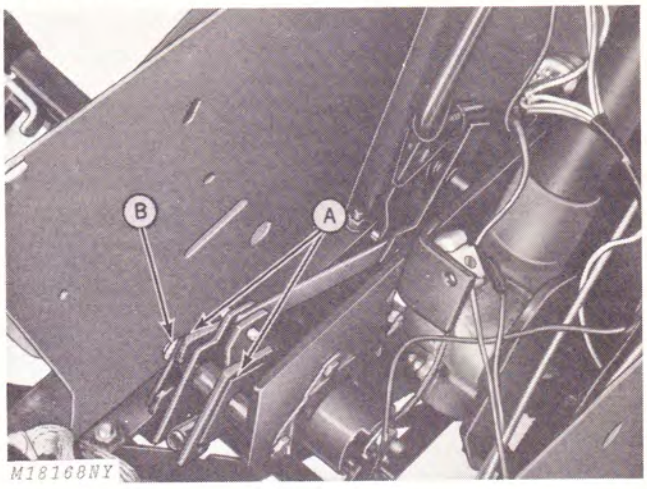
IMPORTANT: Be sure control lever on dash remains in neutral position "N" after adjusting.

Loosen jam nut (G). Turn clevis (H) until drilled pin (B) can be installed. Secure drilled pin with cotter pin, Fig. 32.

Tighten jam nut (H).

Shut off engine, and lower tractor to ground.

Adjusting Brake Linkage



A—Brake
B—Lock Nut

Fig. 33-Adjusting Brake Linkage

Turn lock nut (B) until brakes (A) cause a slight drag on the linkage, Fig. 33. This can be felt by moving the control lever as the nut is turned at the brake.

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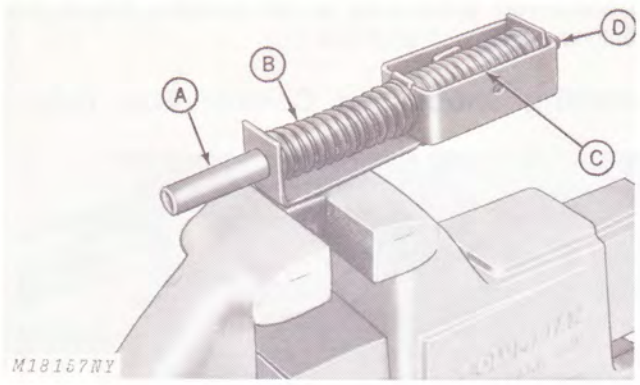
Litho in U.S.A.

Inspecting Slide Assembly—300 Tractor (Serial No. 30,001-55,000)



A—Slider Tube **C—Spring**
B—Spring **D—Guide Rod**

Fig. 17-Testing Slide Assembly

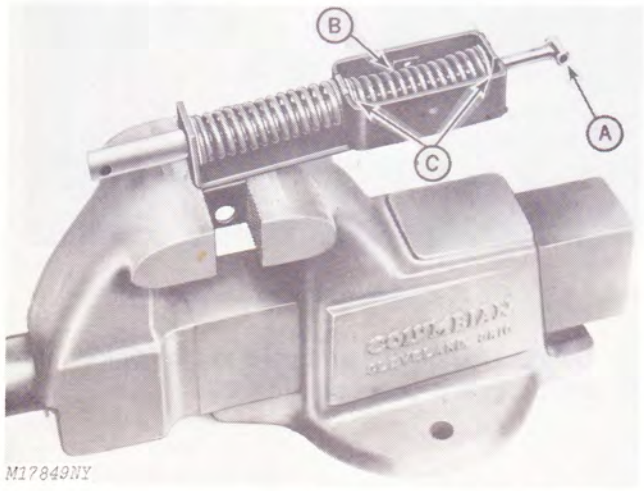
Pull out on slider tube (A). Spring (B) should compress and return slider tube when released, Fig. 17.

Push in on slider tube (A). Spring (C) should compress and return slider tube when released.

Move guide rod (D) in and out to make sure it moves freely.

Disassembling Slide Assembly—300 Tractor (Serial No. 30,001-55,000)

CAUTION: Be careful when removing or installing springs in the slide assembly.

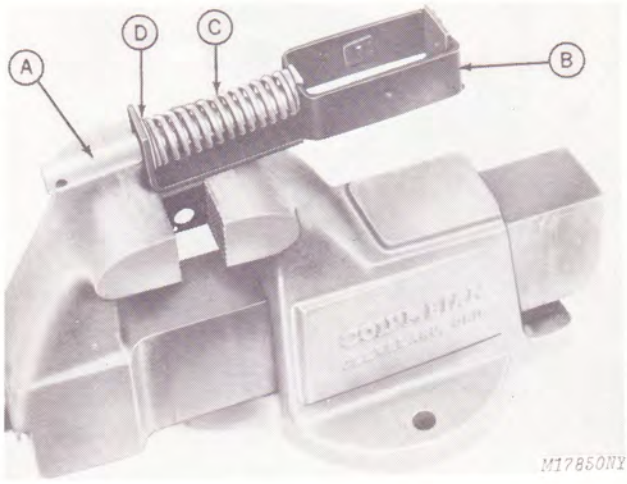


A—Guide Rod **B—Spring** **C—Spring Guide**

Fig. 18-Removing Guide Rod and Spring

Pull guide rod (A) out of slide assembly, Fig. 18.

Remove spring (B) and two spring guides (C).



A—Slider Tube **C—Spring**
B—Slide **D—Spring Guide**

Fig. 19-Removing Slider Tube and Spring

Pull slider tube (A) back into slide (B), Fig. 19.

Remove spring (C) and spring guide (D).

Remove slider tube (A) from spring.

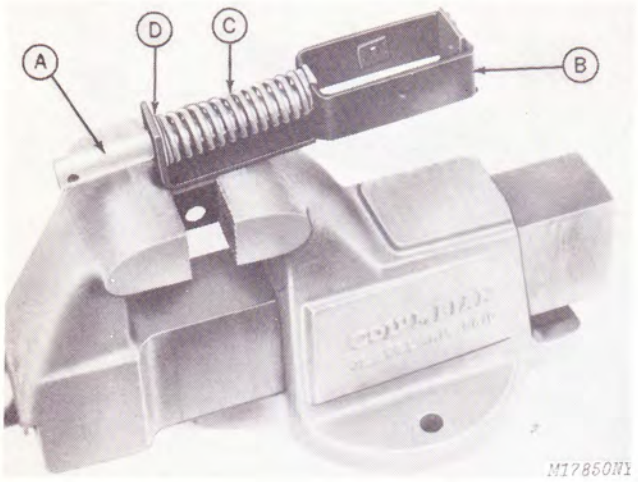
Repairing Slide Assembly—300 Tractor (Serial No. 30,001-55,000)

Clean dirt and corrosion from all parts.

Replace any worn or damaged parts.

Measure the free length of springs. Both should be 4.31 inches (10.95 cm) long.

Assembling Slide Assembly—300 Tractor (Serial No. 30,001-55,000)

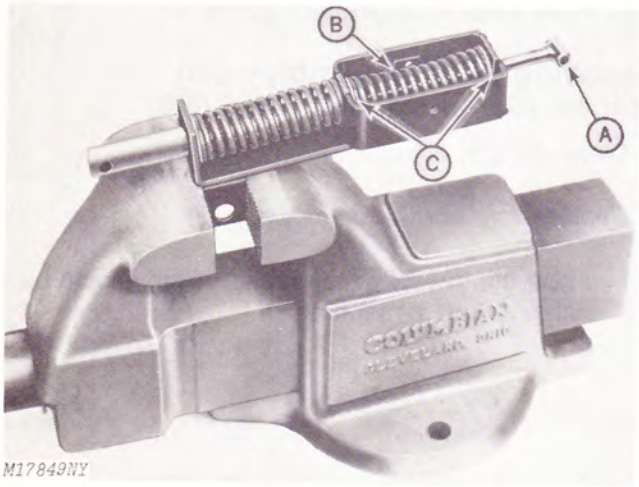


A—Slider Tube **C—Spring**
B—Slide **D—Spring Guide**

Fig. 20-Installing Slider Tube and Spring

Install spring guide (D) and spring (C) over slider tube (A), Fig. 20.

Install slider tube in slide (B) and compress spring until it can be installed in open part of slide as shown.



A—Guide Rod **B—Spring** **C—Spring Guide**

Fig. 21-Installing Guide Rod and Spring

Install JDM-70 Valve Spring Compressor over two spring guides (C) and spring (B) to compress the spring.

Install spring (B) and spring guides (C) in slide, Fig. 21.

Install guide rod (A) into slide assembly.

INSTALLATION

NOTE: Remove parking brake knob and pull parking brake rod forward as far as possible to aid in installing shock bolt and lock nut.

Installing Shock and Control Arm Yoke

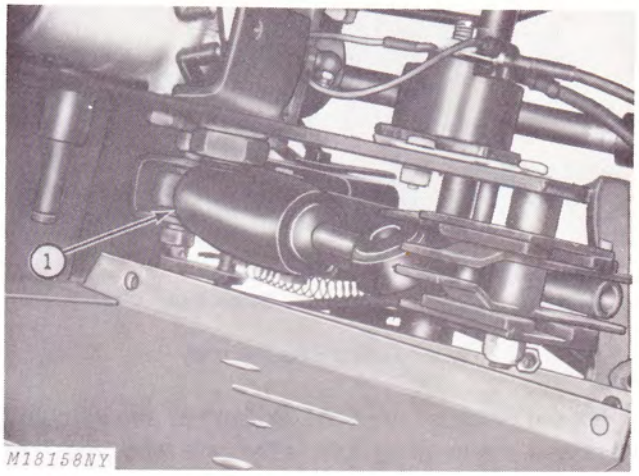


Fig. 22-Attaching Shock Absorber

1. Install the barrel end of shock absorber to the mount on the tractor frame, Fig. 22.

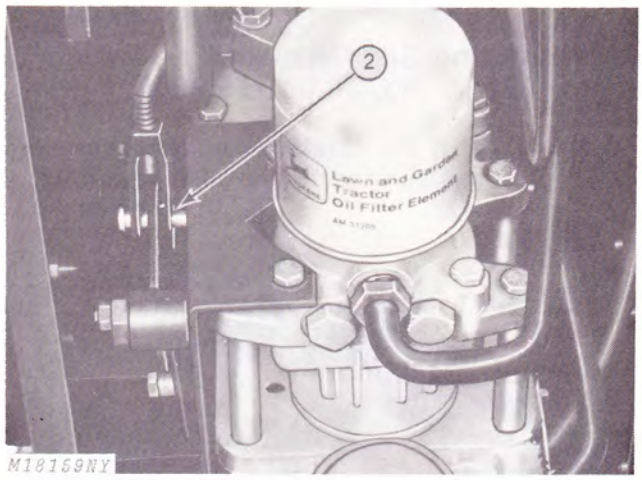


Fig. 23-Connecting Control Linkage

2. Connect the control arm yoke to the control arm with drilled pin and cotter pin, Fig. 23.

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Installing Slide Assembly— 300 Tractor (Serial No. 30,001-55,000)

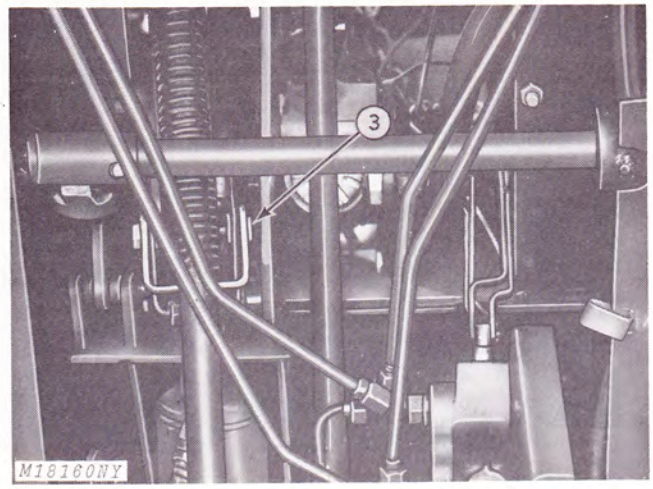


Fig. 24-Attaching Slide Assembly to Linkage

3. Attach the slide assembly to the control arm link with two shoulder bolts, Fig. 24.

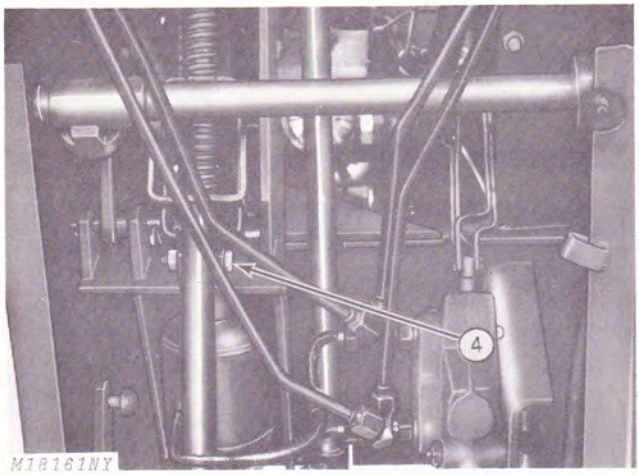


Fig. 25-Mounting Slide Assembly to Tractor

4. Attach the lower end of the slide assembly to the tractor with bolt and lock nut, Fig. 25.

Attaching Shock Absorber

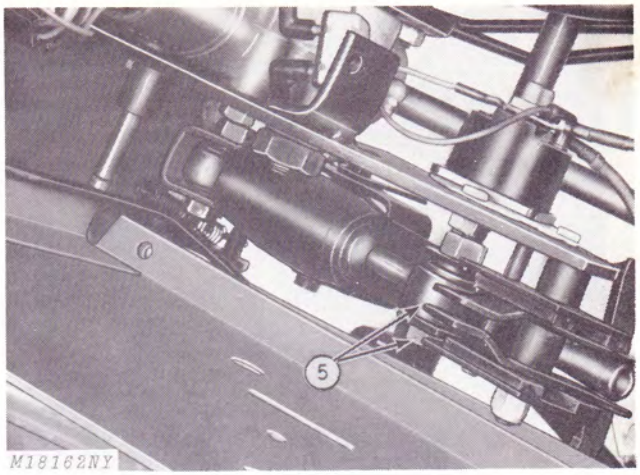


Fig. 26-Attaching Shock Absorber to Slide Assembly

5. Attach the upper portion of the shock absorber.

Installing Roller Arm

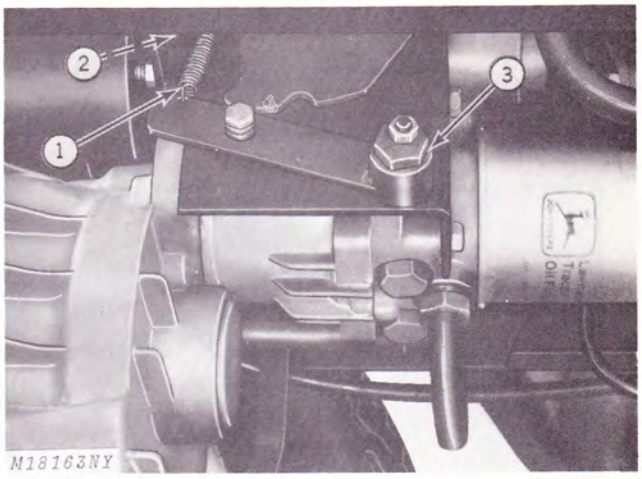


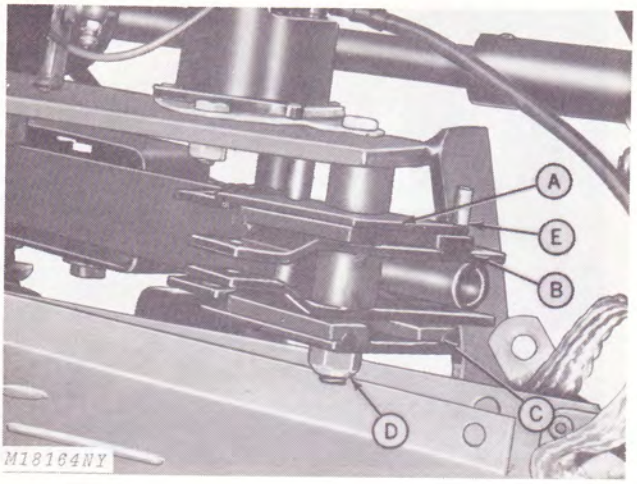
Fig. 27-Installing Roller Arm

1. Attach the spring to the roller arm.

2. Attach the spring to the cotter pin mounted on the tractor frame.

3. Slide roller arm onto the pivot shaft and secure with lock nut.

Installing Linkage Brake



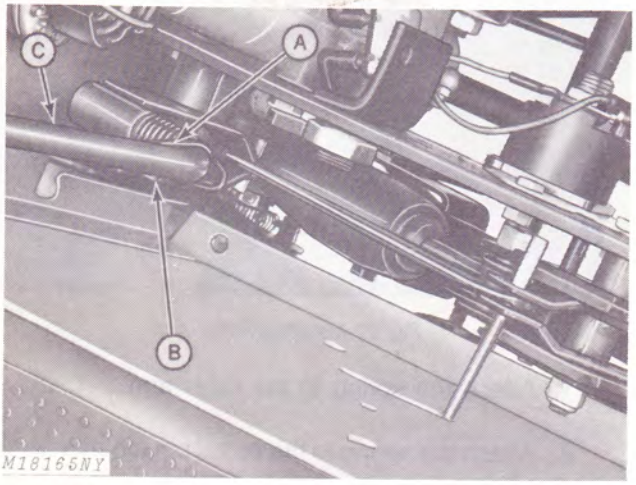
A—Inner Brake Pad
B—Yoke
C—Outer Brake Pad
D—Lock Nut
E—Roll Pin

Fig. 28-Installing Linkage Brake

Slide inner brake pad (A), yoke (B) and outer brake pad (C) onto pivot. Secure with lock nut (D), Fig. 28.

Attach the slide assembly with roll pin (E).

Installing Control Lever



A—Spring
B—Retaining Ring
C—Control Lever

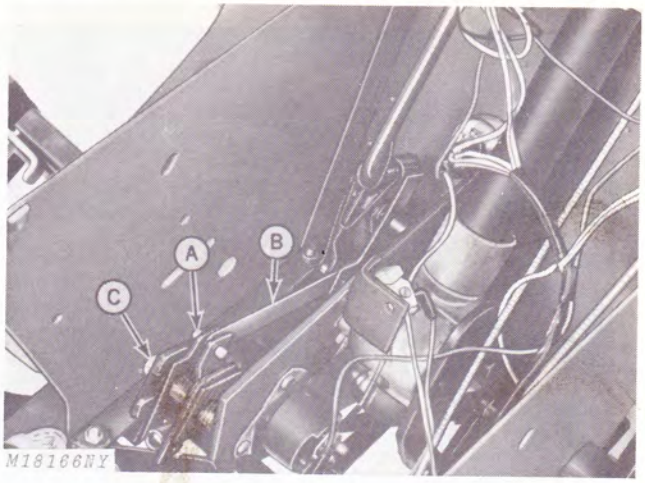
Fig. 29-Installing Control Lever

Slide control lever (C) onto pivot and install retaining ring (B), Fig. 29.

Install knob (not illustrated).

Secure top of spring (A) on control lever.

Connecting Upper Linkage



A—Roll Pin
B—Upper Link
C—Lock Nut

Fig. 30-Connecting Upper Linkage

Lower upper link (B) into position and install roll pin (A), Fig. 30.

Adjust lock nut (C) until a slight amount of drag can be felt when moving the control lever.

Securing Spring Pins

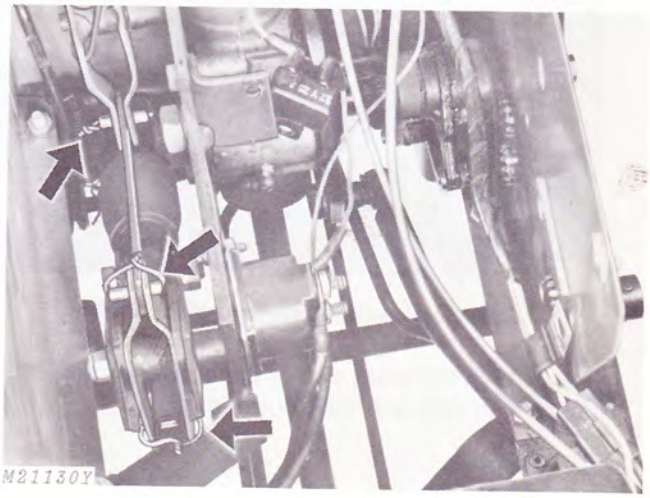
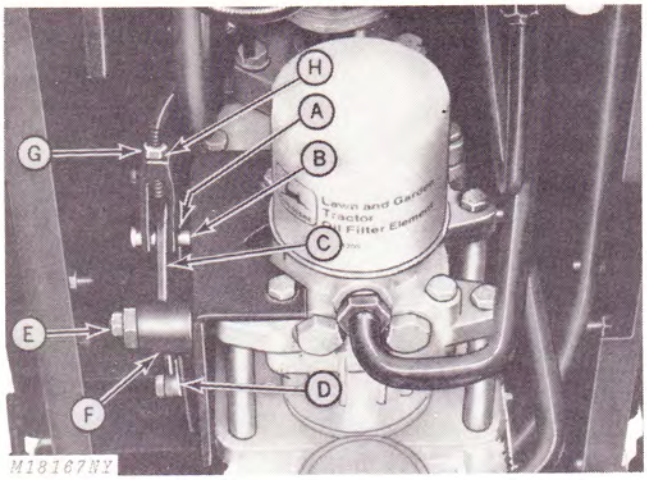


Fig. 31-Securing Spring Pins

Secure linkage spring pins in place by inserting wire through pins (arrow) and twisting ends as shown in Fig. 31 above.

ADJUSTMENTS

Adjusting Hydrostatic Control Linkage



A—Cotter Pin
B—Drilled Pin
C—Control Arm
D—Roller
E—Lock Nut
F—Eccentric
G—Jam Nut
H—Clevis

Fig. 32-Adjusting Hydrostatic Linkage

Block one wheel off ground.

Remove cotter pin (A) and drilled pin (B) from clevis (H).

Move control arm (C) until the roller (D) will seat in the control arm detent.

Start engine.

⚠ CAUTION: Be careful of rotating fan at the rear of the transmission.

Loosen lock nut (E). Turn eccentric until raised wheel stops moving. This means the transmission is fully in neutral.

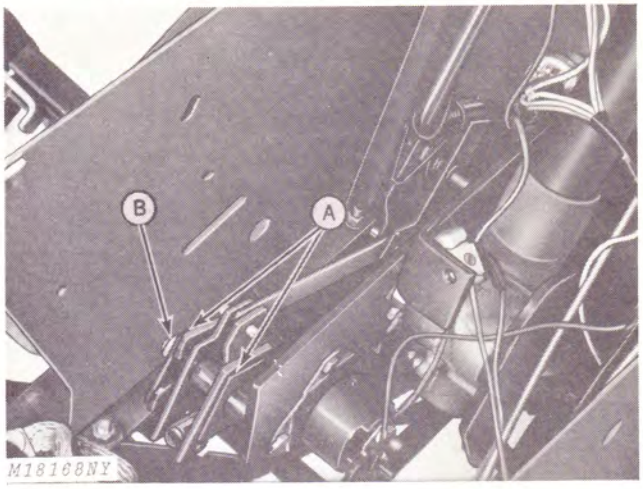
Tighten lock nut (E).

Loosen jam nut (G). Turn clevis (H) until drilled pin (B) can be installed. Secure drilled pin with cotter pin, Fig. 32.

Tighten jam nut (H).

Shut off engine, and lower tractor to ground.

Adjusting Brake Linkage



A—Brake
B—Lock Nut

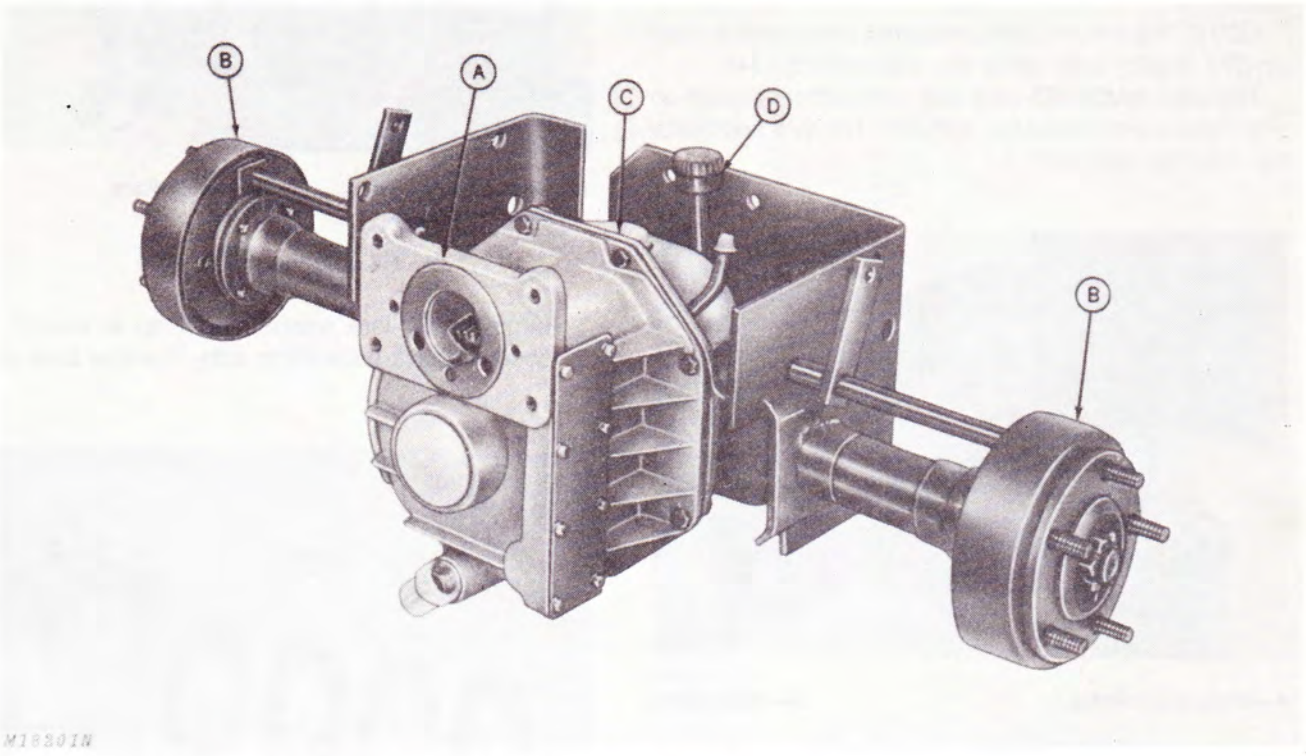
Fig. 33-Adjusting Brake Linkage

Turn lock nut (B) until brakes (A) cause a slight drag on the linkage, Fig. 33. This can be felt by moving the control lever as the nut is turned at the brake.

Litho in U.S.A.

Group 25
DIFFERENTIAL AND AXLE

DESCRIPTION



A—Front Housing
B—Brake and Drum
C—Rear Housing
D—Oil Fill Tube (300 Tractors Serial No. 30,001-71,160)

Fig. 1-Differential and Axle Assembly

The differential and axle, Fig. 1, form the power train final drive.

Power is transmitted from the transmission output gear to the pinion spur gear. The pinion spur gears transmit power directly to the differential drive gears, turning the axles and wheels.

NOTE: 300 Tractors (Serial No. 71,161-80,000) 312, 314 and 316 Tractors are equipped with a different fill tube. See page 10-15-2.

Disassembling Axle

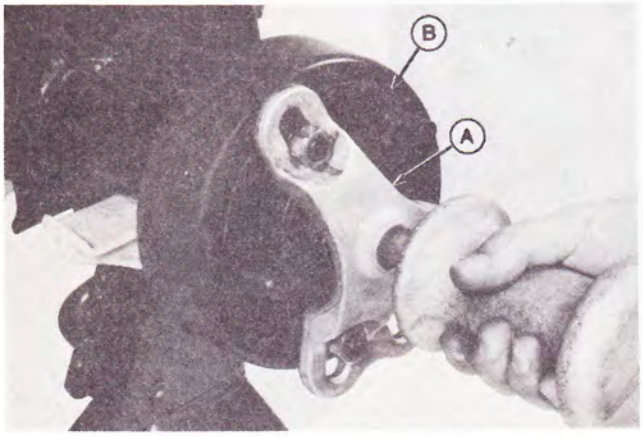
Oil seals, axle shafts, axle bearings and hubs can be serviced without removing the axle and differential housing from the tractor.

When servicing the axle in the tractor, place blocks under the rear hitch plate or tractor frame.

Remove rear wheel or wheels and proceed with disassembly.

NOTE: The old AM35282 axle and differential is used on 314 Tractor with Serial No. 155,229-155,340.

The new AM38462 axle and differential is used on 314 Tractor with Serial No. 155,001-155,228 and Serial No. 155,341-000,000.



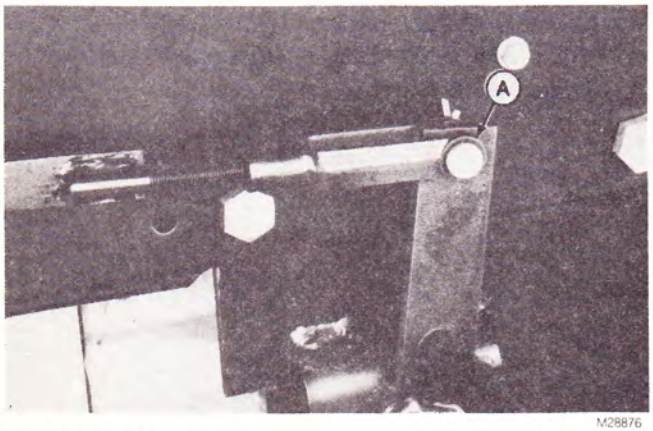
M28858

A—Brake Drum Puller **B—Brake Drum**

Fig. 2-Removing Brake Drum

To remove brake drum, remove cotter pin, nut and washer from shaft.

Install OTC-967-C Brake Drum Puller (A, Fig. 2), and pull brake drum (B) from axle shaft.

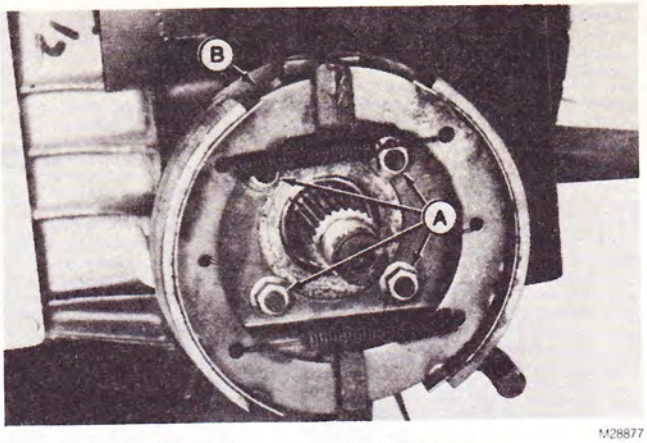


M28876

A—Brake Linkage

Fig. 3-Disconnecting Brake Linkage

Disconnect brake linkage (A, Fig.3).

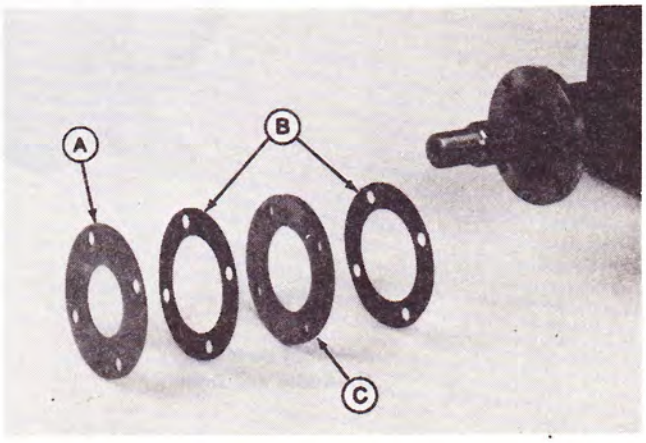


M28877

A—Nuts, Lock Washers and Cap Screws **B—Back Plate**

Fig. 4-Removing Back Plate

Remove nuts, lock washers and cap screws (A, Fig. 4), securing back plate (B) to axle. Remove back plate.



M28878

A—Dust Shield **C—Bearing Retainer**
B—Gasket

Fig. 5-Removing Dust Shield and Gaskets

Remove dust shield (A, Fig. 5), gaskets (B) and bearing retainer (C) from axle shaft end.

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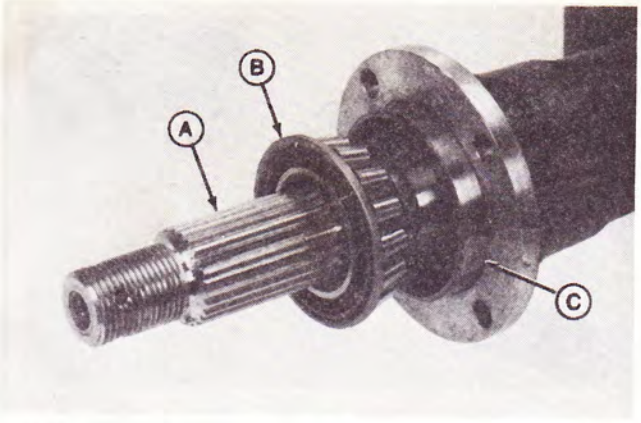


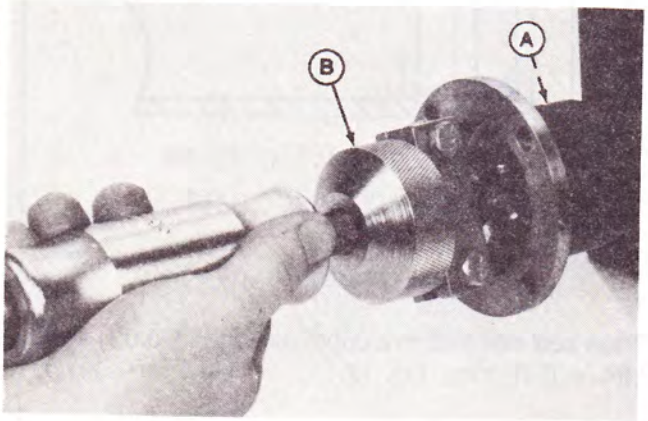
M28879

A—Axle
B—Bearing
C—Race

Fig. 6-Removing Axle.

Grasp end of axle (A, Fig. 6), and pull out axle and bearing (B).

NOTE: Axle bearing and race are cemented together and in most cases will remain together. If bearing (B) and race (C) separate, remove race (C) from housing with your fingers.

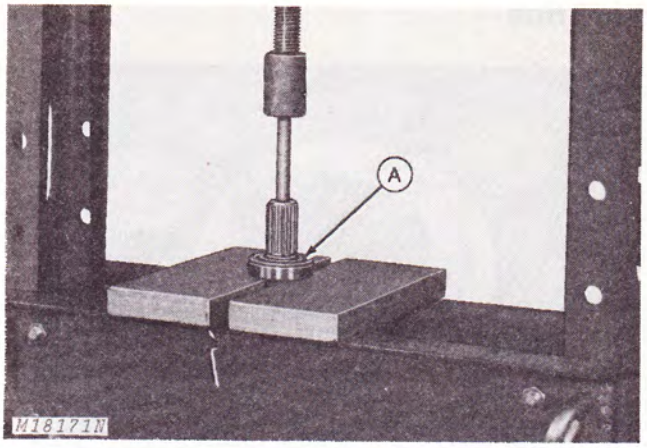


M28880

A—Seal
B—Puller

Fig. 7-Removing Seal

Remove seal (A, Fig. 7), using puller (B).



M18171

A—Axle Bearing

Fig. 8-Removing Axle Bearing

Press axle bearing (A, Fig. 8) from axle shaft by supporting inner bearing race on a press bed and applying pressure to splined end of shaft.

Inspecting Axle Parts

Roller Bearings

Clean bearings in suitable solvent. The bearings must be free of rust and other foreign material. Bearings should rotate smoothly without excessive "play". Replace bearings if defective.

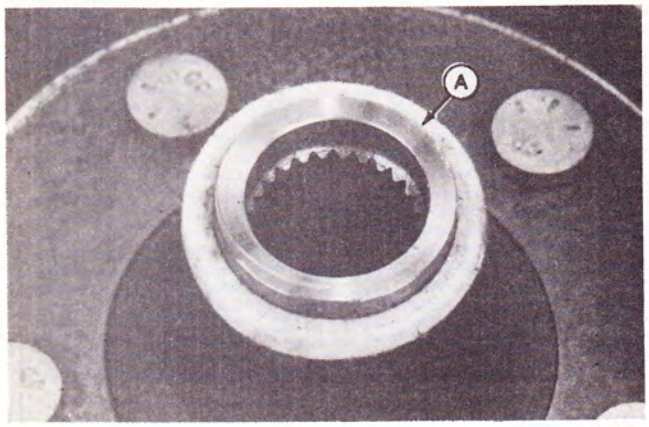
Axles

Inspect axle splines for wear or breaks. Replace axle if defective.

Oil Seals

Inspect oil seals for signs of leaking. Check for cuts or cracks. Be sure spring on inside of seal lip is in place. Replace seal if defective.

Wheel Hub



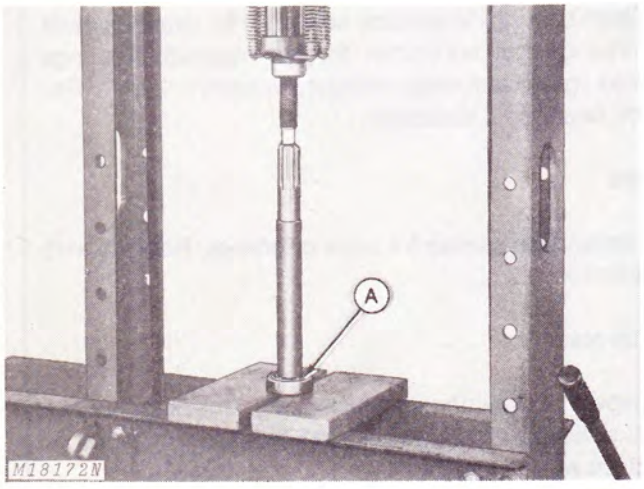
M28884

A—Sealing Surface

Fig. 9-Inspecting Wheel Hub

Inspect sealing surface (A, Fig. 9) of wheel hub. Replace hub if bearing seal has grooved the hub surface more than 1/61 inch (0.40 mm).

Assembling Axle



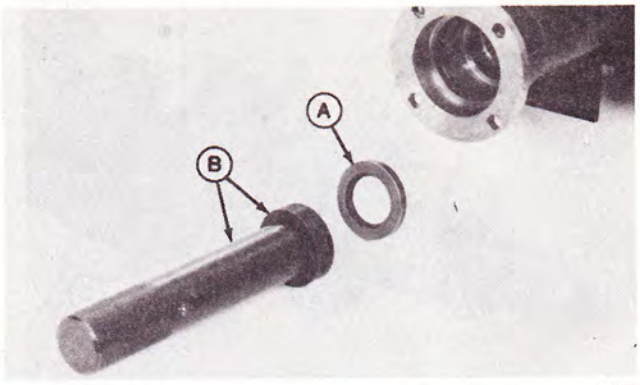
M18172N

A—Bearing

Fig. 10-Installing Axle Bearing

Place bearing (A, Fig. 10) on axle shaft with locking ring to the outside. Position bearing and axle shaft in a press. Press bearing onto shaft until firmly seated against shaft shoulder.

NOTE: Pack bearing with multi-purpose grease.

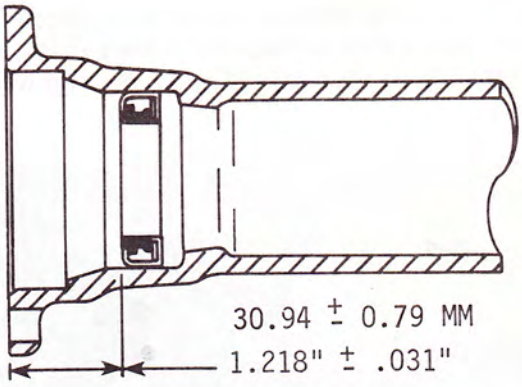


M28885

A—Seal **Driver and Disc 27511**

Fig. 11-Installing Seal

Install seal (A, Fig. 11), using driver and disc #27511 (B). Lips of seal point toward inside of axle.

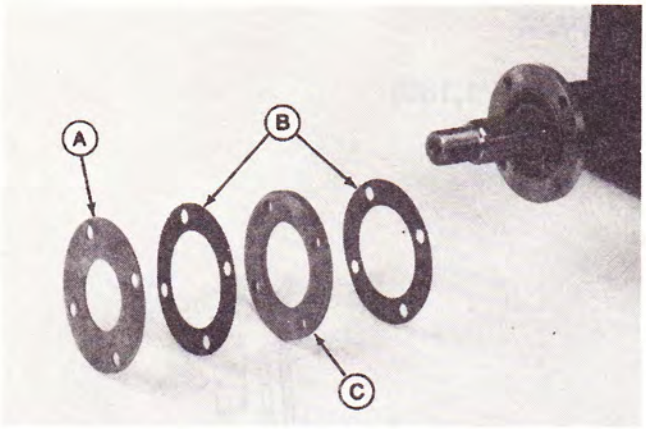


M28886

Fig. 12-Seal Depth

Press seal into axle to a depth of 1.218 ± 0.031 inch (30.94 ± 0.79 mm), Fig. 12.

Slide axle shaft into housing.



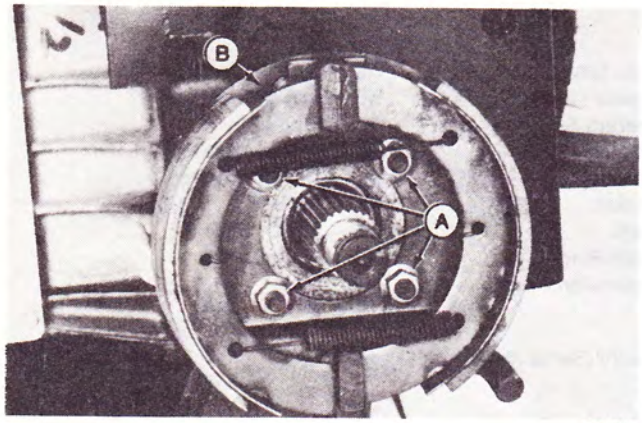
M28878

A—Dust Shield
B—Gaskets
C—Bearing Retainer

Fig. 13-Installing Gaskets and Dust Shield

Install gaskets (B, Fig. 13), dust shield (A) and bearing retainer (C) on axle shaft.

NOTE: It may be necessary to install more than one gasket between end of axle tube and bearing retainer (C) if wheel bearing protrudes slightly. The side of bearing retainer (C) marked with an "X" faces outward (toward wheel).



M28887

A—Cap Screws, Lock Washers, and Nuts
B—Back Plate

Fig. 14-Installing Back Plate

Install back plate (B, Fig. 14) on axle shaft. Secure with cap screws, lock washers and nuts (A).

Tighten nuts (B) to 15 ft. lbs. (20 Nm) torque.

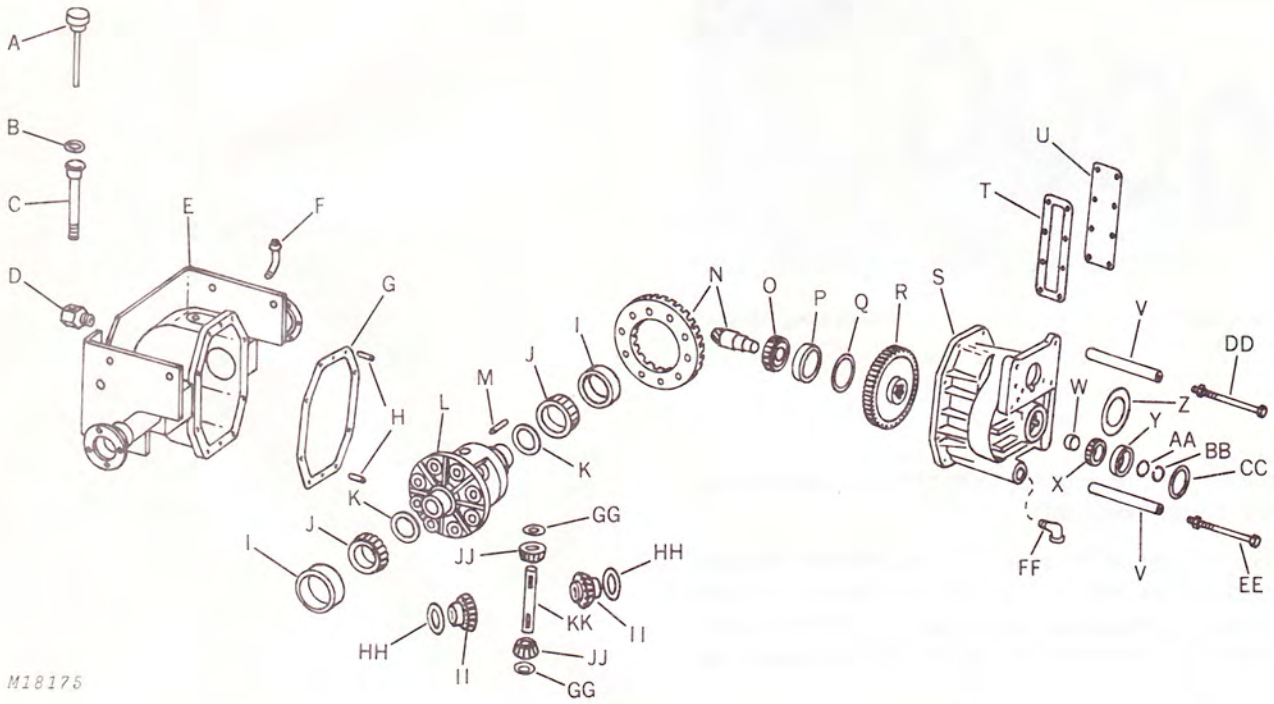
Install hub and drum as shown on page 50-10-6.

Connect brake linkage and check brake adjustment as instructed in Section 50, Group 10.

Install rear wheels and remove blocking

DIFFERENTIAL REPAIR

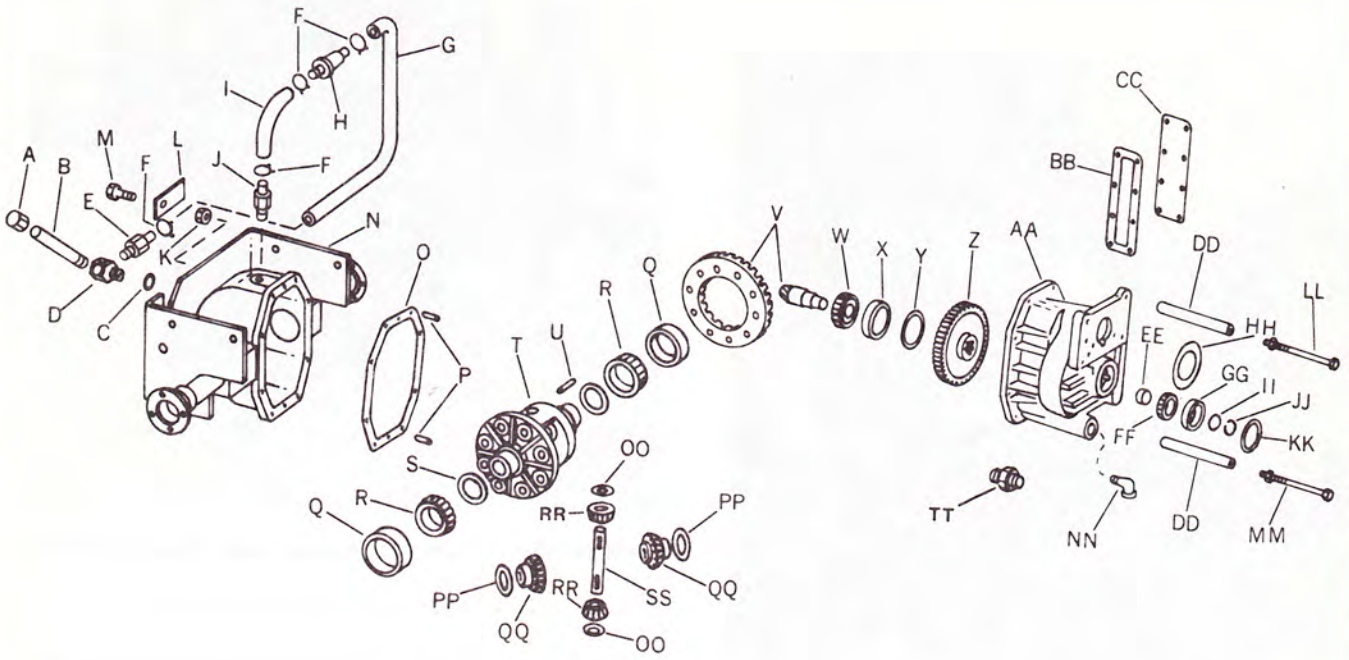
Differential Components - 300 Tractor (Serial No. 30,001-71,160)



A—Dipstick Assembly
B—O-Ring
C—Oil Fill Tube
D—Oil Tube Connector
E—Rear Axle Housing
F—Vent Assembly
G—Housing Gasket
H—Dowel Pins
I —Bearing Cup
J —Bearing
K —Shim
L —Differential Case
M—Pinion Lock Pin
N —Ring and Pinion Gear
O —Bearing Cone
P —Bearing Cup
Q —Shims
R —Spur Gear
S —Front Housing Assembly
T —Gear Cover Gasket
U—Gear Cover
V—Spacer (4 used)
W—Bearing Spacer
X—Bearing
Y—Bearing Cup
Z—Gasket
AA —Shim
BB —Snap Ring
CC —Expansion Plug
DD —Cap Screw (Upper)
EE —Cap Screw (Lower)
FF —Elbow
GG —Thrust Washer
HH —Thrust Washer
II —Axle Gear
JJ —Pinion Gear
KK —Pinion Shaft

Fig. 15-Differential Components For 300 Tractor (Serial No. 30,001-71,160)

Differential Components—300 Tractor (Serial No. 71,161-80,000), 312, 314 and 316 Tractors

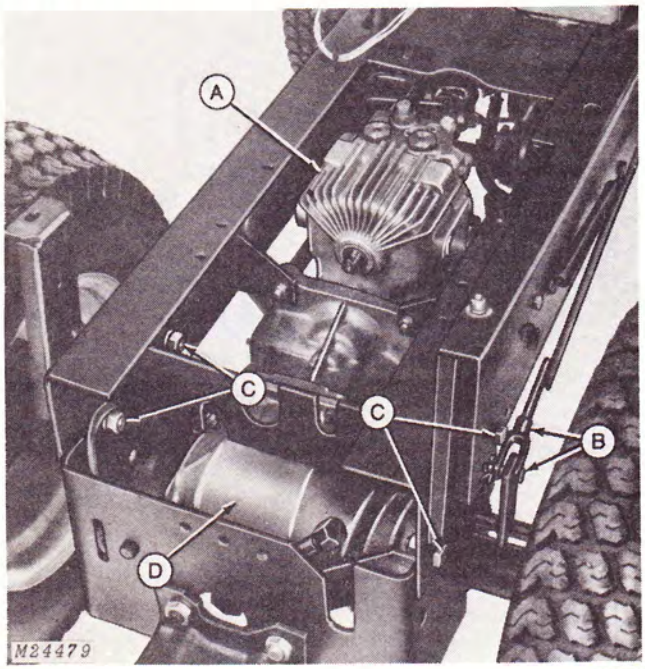


A —Cap
B —Oil Fill Pipe
C —O-Ring
D —Large Connector
E —Small Connector
F —Clamp
G —Long Tube
H —Accumulator
I —Short Tube
J —Small Connector
K —Nut
L —Clamp Plate
M —Bolt
N —Rear Axle Housing
O —Housing Gasket
P —Dowel Pins
Q —Bearing Cup
R —Bearing
S —Shim
T —Differential Case
U —Pinion Lock Pin
V —Ring and Pinion Gear
W —Bearing Cone
X —Bearing Cup
Y —Shims
Z —Spur Gear
AA —Front Housing Assembly
BB —Gear Cover Gasket
CC —Gear Cover
DD —Spacer (4 used)
EE —Bearing Spacer
FF —Bearing
GG —Bearing Cup
HH —Gasket
II —Shim
JJ —Snap Ring
KK —Expansion Plug
LL —Cap Screw (Upper)
MM —Cap Screw (Lower)
NN —Elbow (Used on some 300 Tractors)
OO —Thrust Washer
PP —Thrust Washer
QQ —Axle Gear
RR —Pinion Gear
SS —Pinion Shaft
TT —Connector

Fig. 16-Differential Components For 300 Tractor (Serial No. 71,161-80,000), 312, 314 and 316 Tractors

REMOVING TRANSMISSION AND DIFFERENTIAL

Remove fender-deck and fuel tank as shown on page 30-20-2.



M24479

A—Transmission
B—Brake line
C—Cap Screws, Nuts and Lock Washers
D—Differential and Axle Assembly

Fig. 17-Removing Transmission and Differential

Drain transmission fluid and remove transmission (A, Fig. 17), as instructed in Section 50, Group 15.

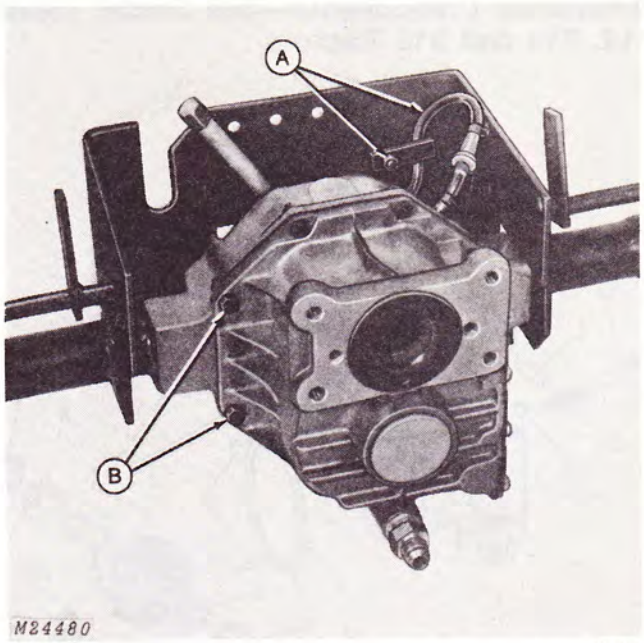
Block up rear of tractor under frame rails and remove rear wheels. Support differential and axle assembly with a jack.

Disconnect brake line (B, Fig. 17).

Remove cap screws, nuts and lock washers (C). Remove differential and axle assembly (D) from the tractor.

DIASSEMBLING DIFFERENTIAL

Remove axle assemblies as explained on page 50-25-2.

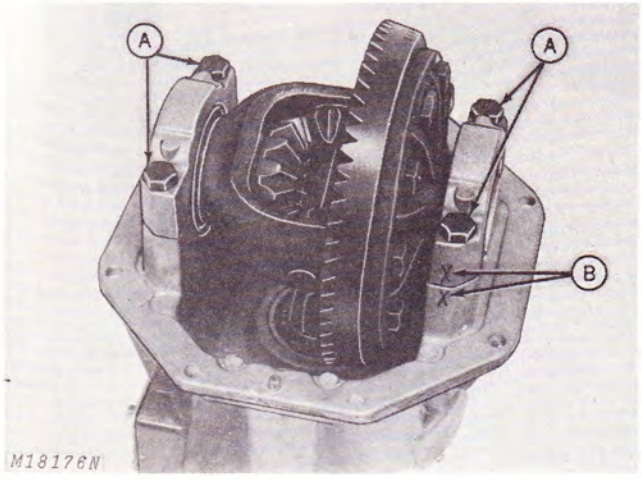


M24480

A—Sight Tube
B—Cap Screws, Lock Washers, and Nuts

Fig. 18-Separating Front and Rear Housing

Remove cap screws, lock washers and nuts (B, Fig. 18), and separate front and rear axle housings. Loosen cap screw and remove sight tube. (A).



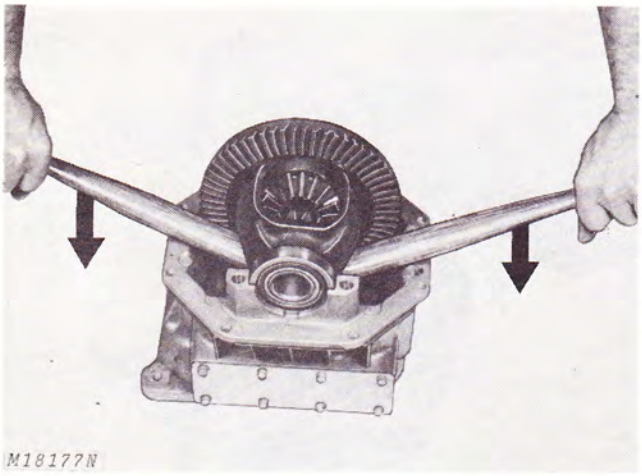
M18176

A—Cap Screws **B—Mark**

Fig. 19-Removing Bearing Caps

Mark one bearing cap as illustrated (B, Fig. 19) before removing cap.

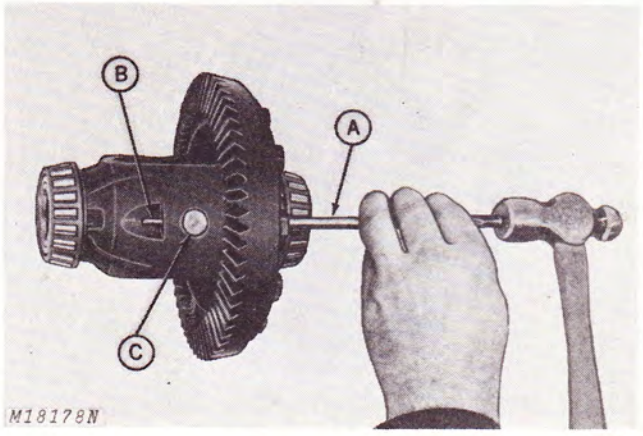
Remove cap screws (A) and remove caps. Set caps in a place where machined surfaces will not be damaged.



M18177

Fig. 20-Removing Differential Assembly

To remove differential assembly, Fig. 20, place two wooden handles under differential case and pry sharply upward. Remove differential assembly.

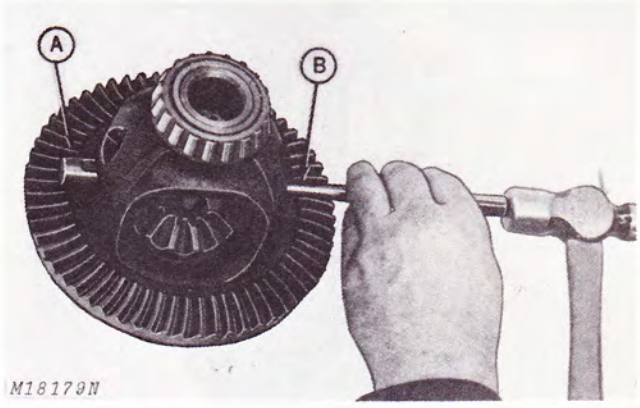


M18178

A—Drift Punch **B—Pinion Pin** **C—Pinion Shaft**

Fig. 21-Removing Pinion Pin

Using a long, thin drift punch (A, Fig. 21), drive pinion pin (B) out of pinion shaft (C).

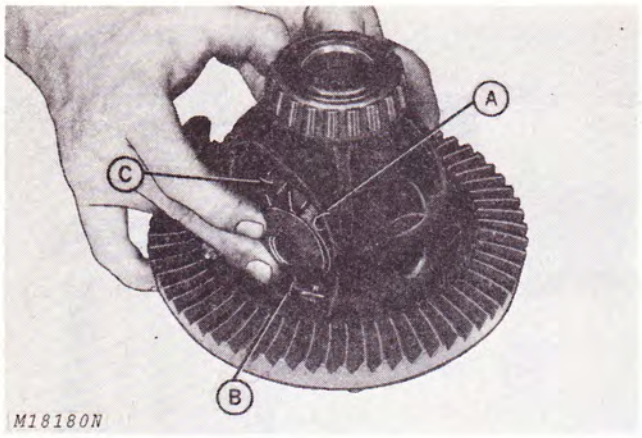


M18179

A—Pinion Shaft **B—Drift Punch**

Fig. 22-Removing Pinion Shaft

Drive pinion shaft (A, Fig. 22), from differential case with long drift punch (B).



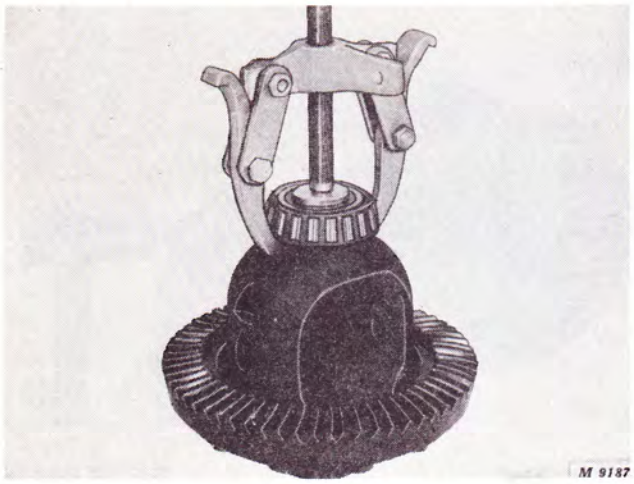
M18180

A—Pinion Gear **B—Thrust Washer** **C—Axle Gear**

Fig. 23-Removing Differential Gears

Rotate gears (A, Fig. 23) 90 degrees to the openings in case. Remove gears and thrust washers (B).

Remove axle gears (C) and thrust washers from case.

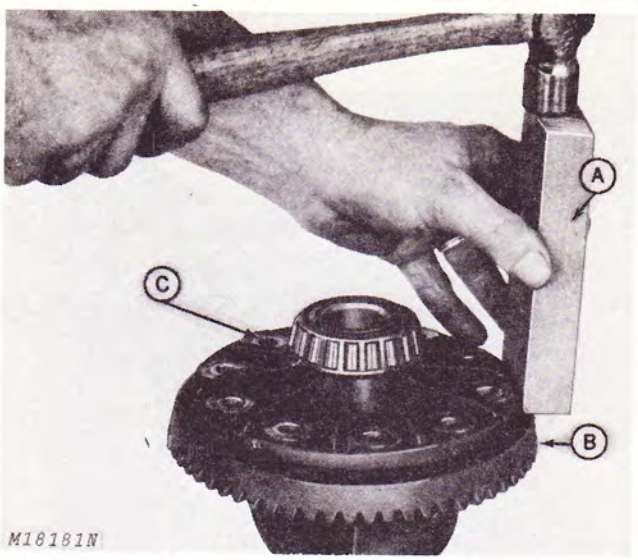


M19187

Fig. 24-Removing Differential Case Side Bearings

Bearings are easily damaged in removal. Do not remove bearings from case unless bearing damage is evident.

Remove bearings with a narrow jaw puller, Fig. 24. Insert jaws into indentations in case.

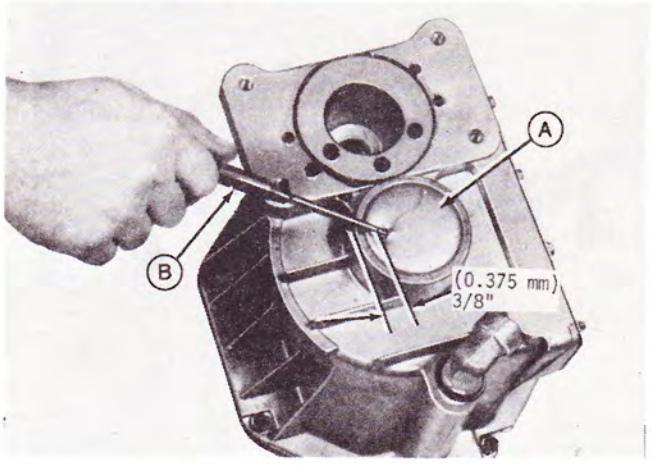


M18181N

A—Wood Block **C—Differential Case**
B—Ring Gear

Fig. 25-Removing Ring Gear

Remove ring gear retaining cap screws. Drive ring gear (B) off differential case (C, Fig. 25), using hardwood block (A) and hammer.

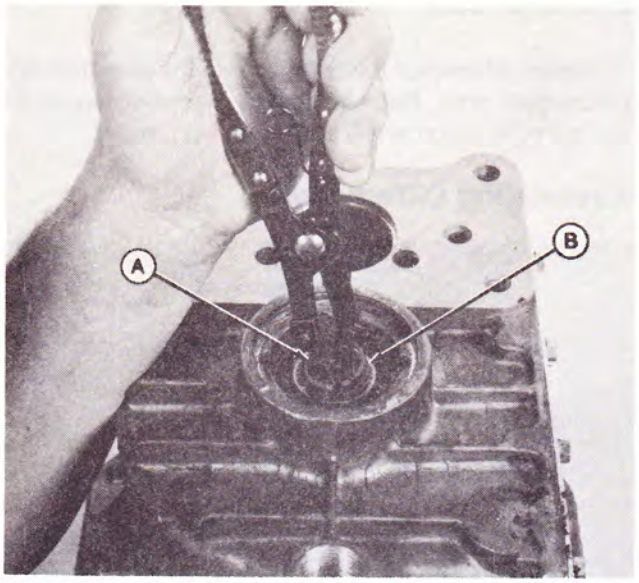


M18182

A—Expansion Plug **B—Punch**

Fig. 26-Removing Pinion Expansion Plug

Remove plug (A, Fig. 26) by driving pointed punch (B) through plug about ⅜ inch (0.375 mm) from outer edge. When hole is large enough, insert a large screwdriver and pry plug out.

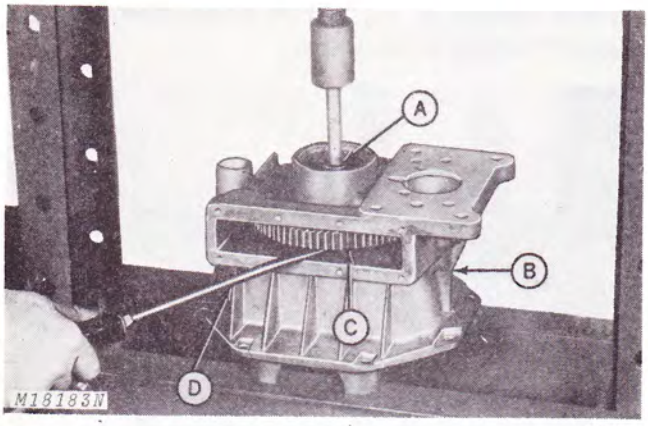


M28888

A—Snap Ring **B—Shim**

Fig. 27-Removing Snap Ring

Remove snap ring (A, Fig. 27), and shim (B) from end of pinion.



M18183N

A—Pinion Shaft **C—Spur Gear**
B—Front Housing **D—Screwdriver**

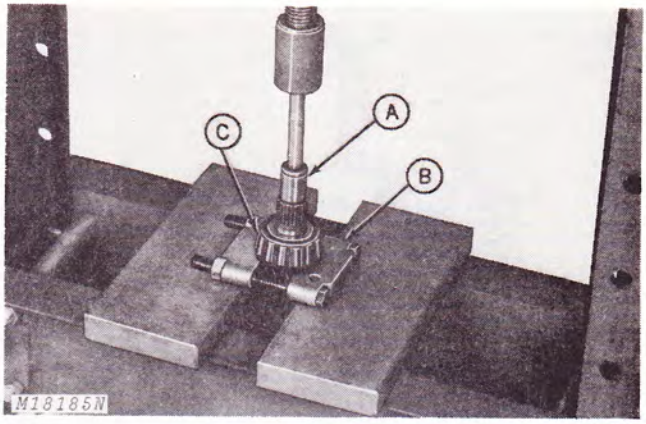
Fig. 28-Removing Differential Pinion Drive Gear Assembly

Position housing (B, Fig. 28) and pinion drive gear assembly on a hydraulic press.

Remove side cover and place a screwdriver blade (D) under the edge of gear (C). This will prevent gear from cocking and possibly cracking housing.

IMPORTANT: Do not let the pinion gear fall out of housing. Catch it before it is pressed completely out.

Remove spur gear (C), spacer and outer pinion bearing.



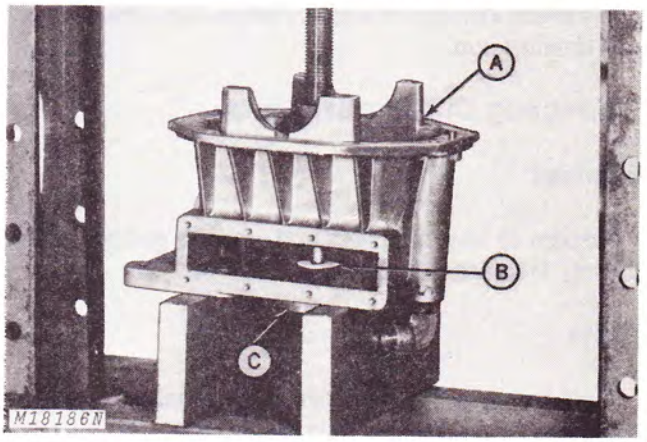
M18185N

A—Pinion Drive Gear **C—Pinion Bearing**
B—Puller

Fig. 29-Removing Inner Pinion Bearing

Clamp inner pinion bearing (C, Fig. 29) in a gear puller (B) with a thin edge.

Position unit in press and carefully push drive gear (A) out of bearing. DO NOT let drive gear drop on the floor.

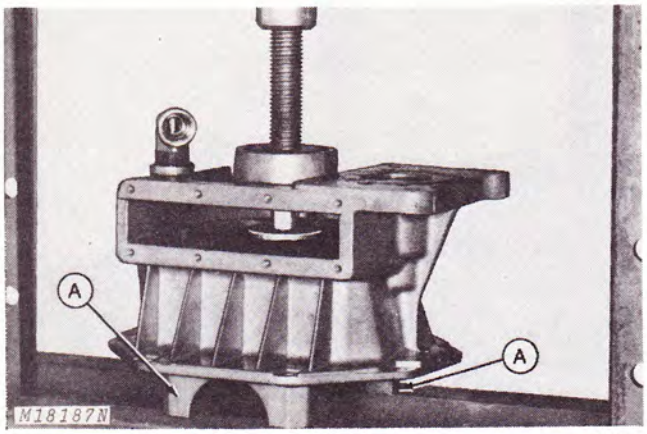


M18186

A—Housing **C—Pinion Bearing Cup**
B—Press Plate

Fig. 30-Removing Outer Pinion Bearing Cup

Position housing (A, Fig. 30), in press. Place press plate (B) of the proper size against cup (C). Press cup out of housing.



M18187N

A—Bearing Saddles

Fig. 31-Removing Inner Pinion Bearing Cup

Position front housing on a press bed with bearing saddles (A, Fig. 31) resting on press bed. Protect bearing saddles with a strip of wood if press bed is rough.

Insert a press plate of proper size and press bearing cup toward inside of housing. Retain shims located under bearing cup.

Inspecting Differential Parts

Bearings

Inspect all bearing rollers and cups for galling, rust or flaking. Replace if necessary.

Gears

Check ring, pinion, and pinion drive gears for abnormal wear and damage. Replace if worn.

Inspect spur gear for spline or tooth wear. Replace if worn.

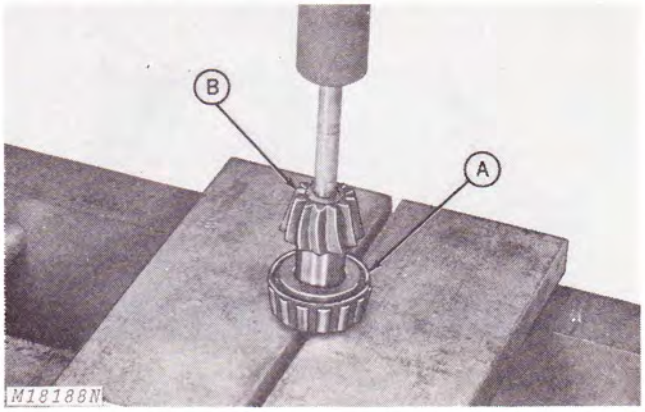
Axle Housings

Inspect housings for cracks and external damage that could affect the operation of axle assembly.

Differential Case

Inspect differential case for wear in the axle gear and pinion gear area. Replace case if machined areas are scored or if pinion shaft fits loosely in bore.

Assembling Differential

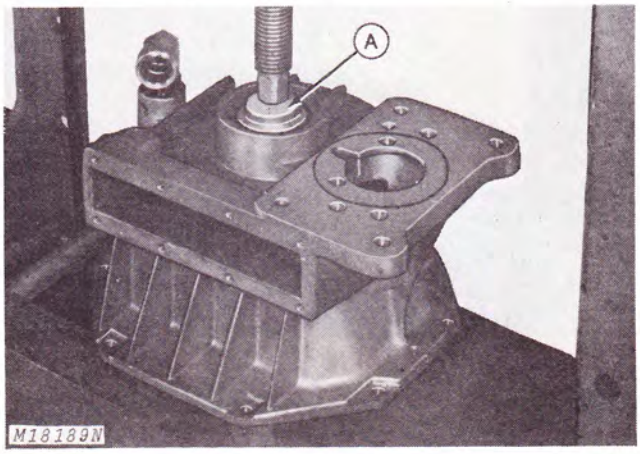


M18188N

A—Inner Pinion Bearing **B—Pinion Drive Gear**

Fig. 32-Installing Inner Pinion Bearing

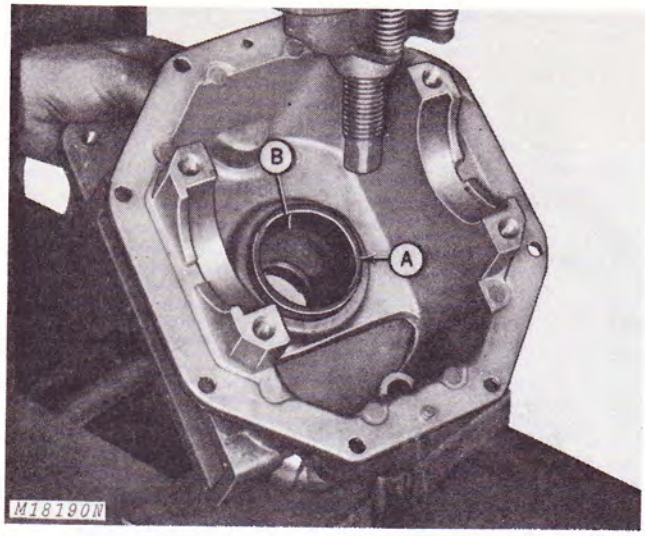
Press bearing (A, Fig. 32) on pinion drive gear (B). Support bearing on inner cup.



M18189

Fig. 33-Installing Outer Pinion Bearing Cup

Position front housing on press. Using a press plate, push outer pinion bearing cup (A, Fig. 33) into housing until it bottoms.



M18190N

A—Bearing cup **B—Shims**

Fig. 34-Installing Inner Pinion Bearing Cup

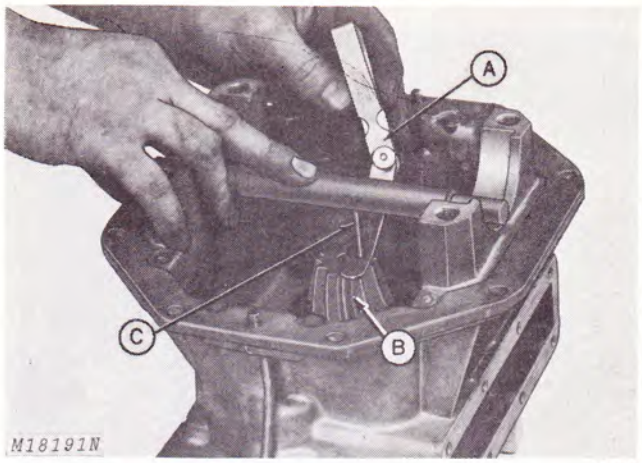
When installing a new inner pinion bearing and cup (A, Fig. 34) in the original housing, reuse the original shim(s) (B).

Use a press plate to push bearing cup (A) into housing until it bottoms.

NOTE: If a new housing is installed, proceed as follows:

When installing a NEW front housing, press bearing cup (A, Fig. 34), into housing WITHOUT shims. Place pinion drive gear (with bearing installed) into bearing cup (A).

NOTE: Measure pinion depth using JDST-10 or JDST-10A Pinion Depth Gauge to attain proper shim thickness. Shims are available in 0.003, 0.005, 0.010 and 0.030 inch (0.0762, 0.1270, 0.254 and 0.762 mm) sizes. Select and combine shim(s) as needed to attain proper pinion depth. When thickness is determined, remove pinion drive gear bearing cup (A, Fig. 34). Install required shim(s) (B) and reinstall bearing cup into housing.



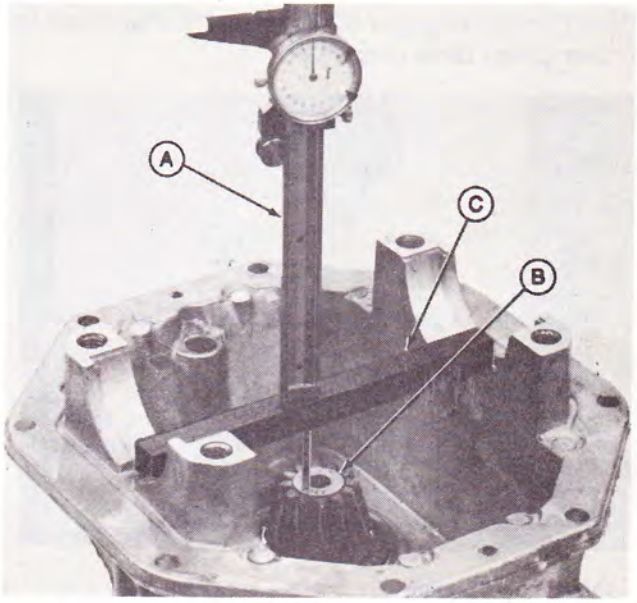
M18191

A—Feeler Gauge **C—JDST-10 Pinion Depth Gauge**
B—Pinion Gear

Fig. 35-Measuring Pinion Depth With JDST-10 Pinion Depth Gauge

Position JDST-10 Pinion Depth Gauge (C, Fig. 35) into differential bearing cradles.

Using feeler gauge (A), measure distance from tool depth pin to pinion gear (B) button face. The distance measured will be the thickness of the shim pack required under inner pinion bearing cup.



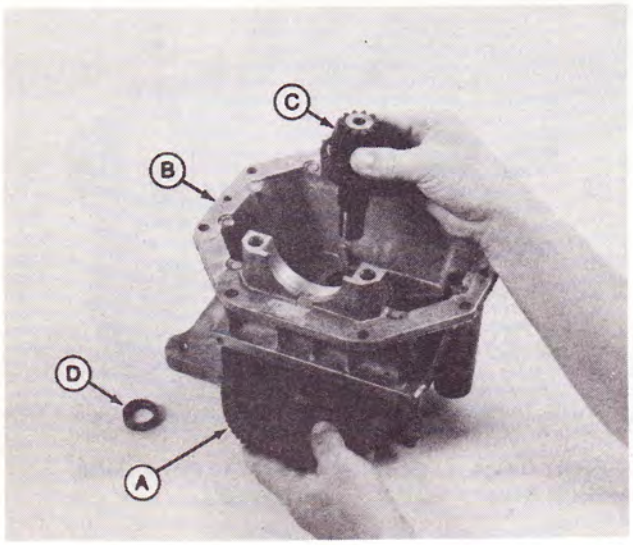
M28889

A—Dial Vernier Caliper **C—JDST-10A Pinion Depth Gauge**
B—Pinion Gear

Fig. 36-Measuring Pinion Depth With JDST-10A Pinion Depth Gauge

Measure pinion depth using JDST-10A Pinion Depth Gauge (C, Fig. 36) and dial vernier caliper (A) by placing gauge squarely in bearing cradles. Set caliper (A) over hole in gauge (C) and measure down to pinion gear (B) button face. Subtract 1.715 inch (43.56 mm) from reading in dial vernier. The difference will be the thickness of shims required under pinion bearing cup.

Litho in U.S.A.



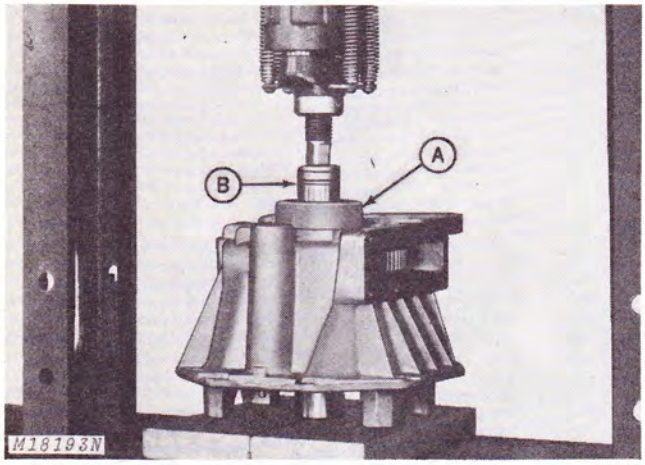
M28890

A—Spur Gear **C—Pinion Drive Gear**
B—Housing **D—Spacer**

Fig. 37-Assembling Pinion Gear

Install spur gear (A, Fig. 37) into housing (B) with chamfered area of center spline toward pinion drive gear (C).

Insert pinion drive gear (C) into gear (A). Place spacer (D) over pinion drive gear shaft.



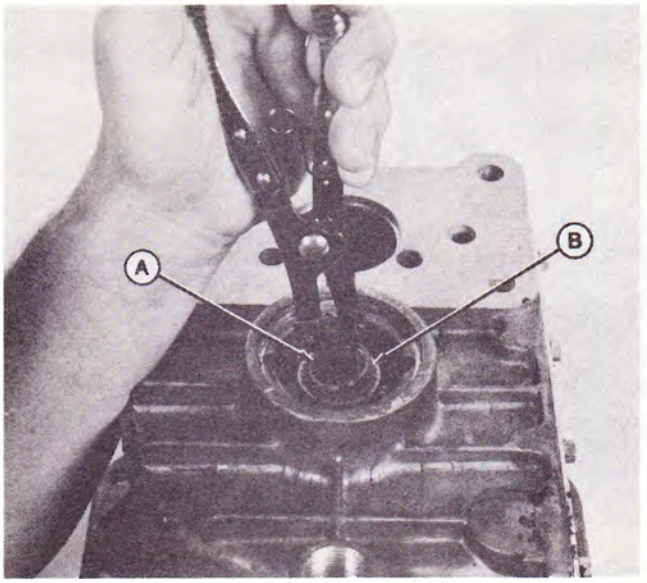
M18193

A—Outer Pinion Bearing **B—Press Sleeve**

Fig. 38-Installing Outer Pinion Bearing

Position housing and pinion drive gear assembly into press. Place outer pinion bearing (A, Fig. 38) over shaft. With a press sleeve (B) of proper diameter, press bearing onto pinion shaft until a slight drag is noticed when gear is turned by hand. If drag is too severe, tap pinion shaft with a soft metal hammer until drag is reduced.

Litho in U.S.A.

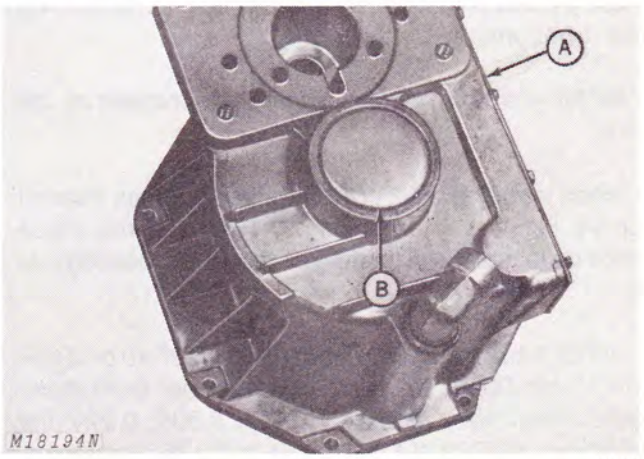


M28888

A—Snap Ring **B—Shim**

Fig. 39-Installing Shim and Snap Ring

Install a shim (B, Fig. 39) and snap ring (A). Use the thickest shim (A) possible which will permit installation of snap ring (B).



M18194

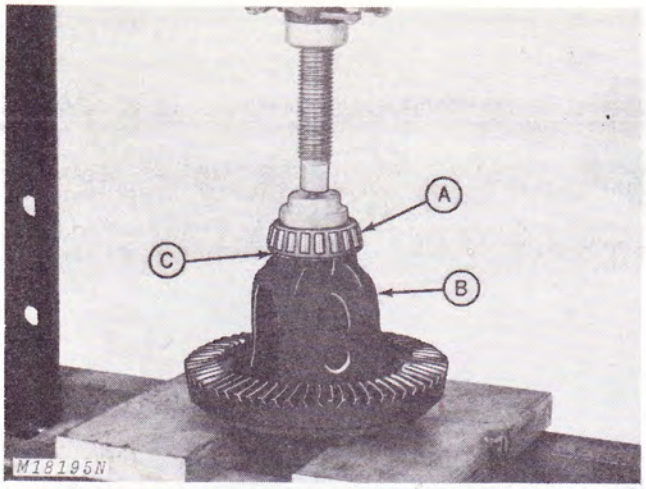
A—Spur Gear Cover **B—Expansion Plug**

Fig. 40-Installing Expansion Plug and Spur Gear Cover

Coat expansion plug (B, Fig. 40) with shellac and expand plug with a 1 inch (25.4 mm) diameter driver. Install expansion plug and spur gear cover (A).

Install gasket and cover (A) on tractors with Serial No. below 155,000 and on 314 Tractors with Serial No. 155,229 through 155,340.

On the 314 Tractors with Serial No. 155,001 through 155,228 and 155,341 and above, apply an even coat of John Deere M64850 Silicon Rubber Adhesive or equivalent on sealing surface of cover (A). Install cover.



M18195N

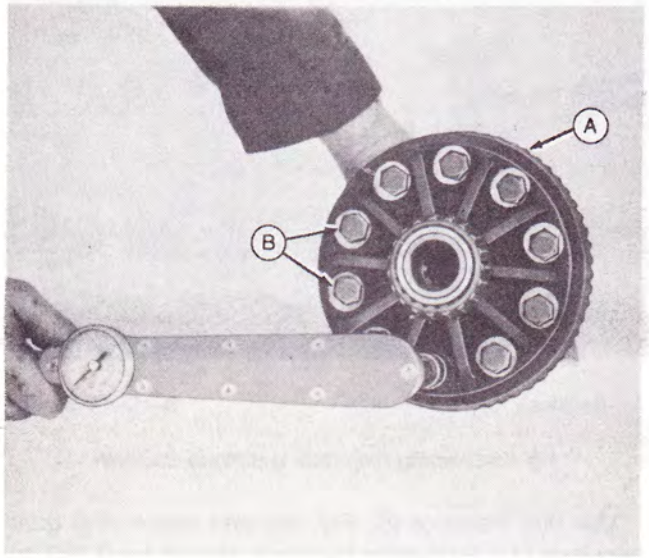
A—Bearing **B—Case** **C—Shims**

Fig. 41-Installing Differential Case Bearings

When installing new differential bearings (A, Fig. 41), reuse original shims (C) or use new shims of the same thickness. Press bearings onto case (B) as shown.

If a new differential case is being installed, start with a 0.020 inch (0.508 mm) pack of shims under each differential bearing.

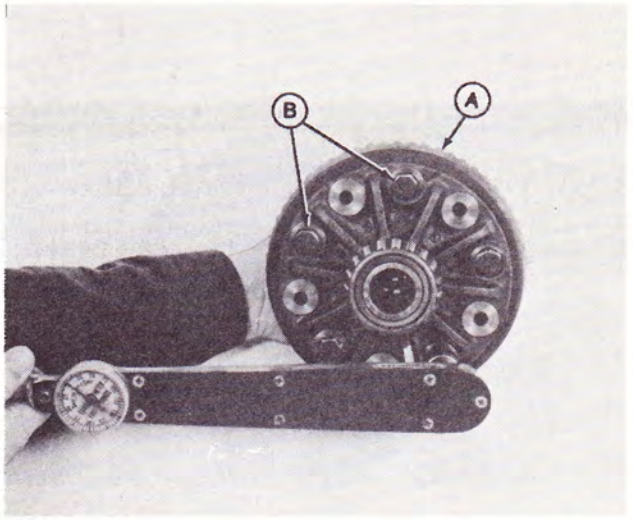
Shims are available in 0.003, 0.005, 0.010 and 0.030 inch sizes (0.0762, 0.1270, 0.254 and 0.762 mm).



M28892

A—Ring Gear **B—Cap Screws**

Fig. 42-Installing Ring Gear - Early Models



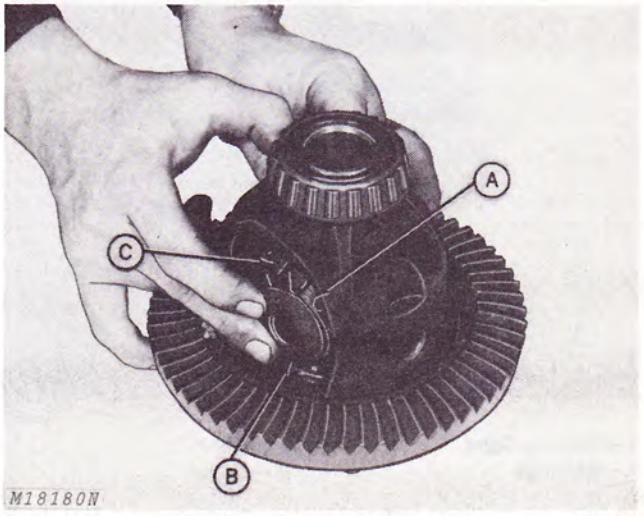
M28891

A—Ring Gear **B—Cap Screws**

Fig. 43-Installing Ring Gear - Later Models

NOTE: Early model cases used 10 cap screws (B, Fig. 42 or 43). Later models use five cap screws. Use number of cap screws provided.

Position ring gear (A) on differential case and start cap screws (B) into gear with fingers. Torque cap screws to 50 to 55 ft-lbs (68 to 75 Nm) in a cross-bolting pattern.

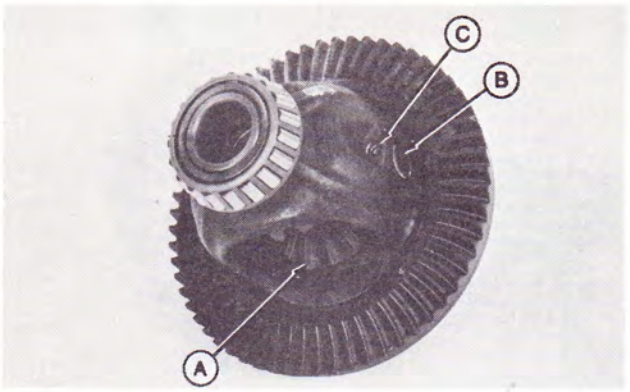


M18180N

A—Power Gear **C—Axle Drive Gear**
B—Thrust Washer

Fig. 44-Installing Differential Gears

Install thrust washers behind axle drive gears (C, Fig. 44) and place gears in differential case. Install differential pinion gears (A) and thrust washers (B).

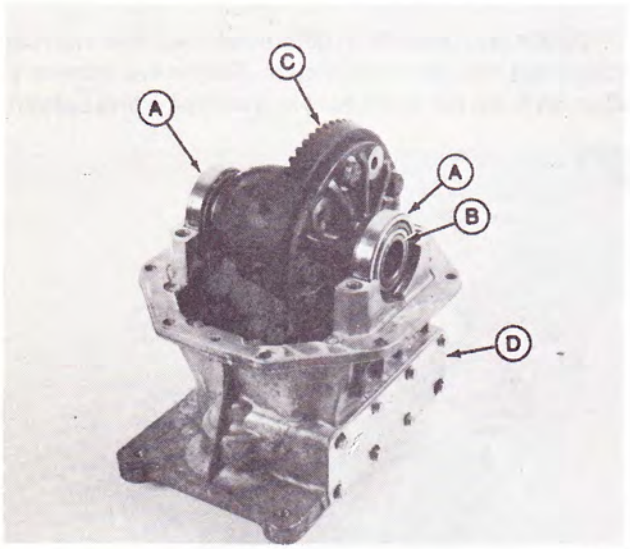


M28893

A—Gears
B—Pinion Shaft **C—Pinion Pin**

Fig. 45-Installing Pinion Shaft

Rotate both gears (A, Fig. 45) at the same time and install pinion shaft (B). Secure with pinion pin (C).

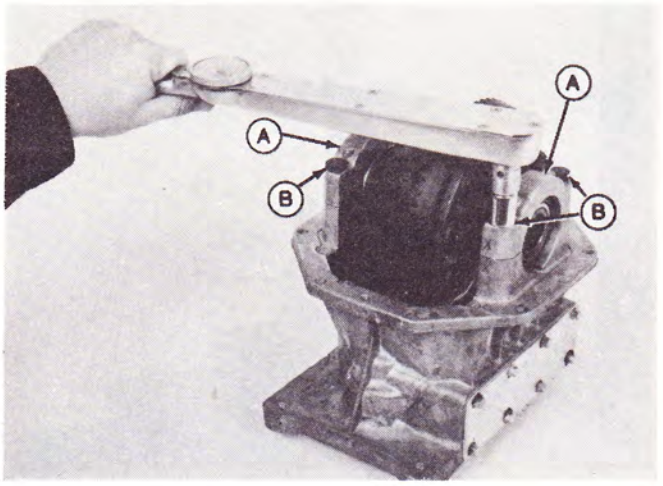


M28894

A —Bearing Cups **C —Gear**
B —Bearings **D —Cover**

Fig. 46-Installing Differential

Place bearing cups (A, Fig. 46) on bearings (B), and insert assembly into bearing cradles. Position assembly with gear (C) on same side as cover (D). Push both bearings (B) into cradles evenly.



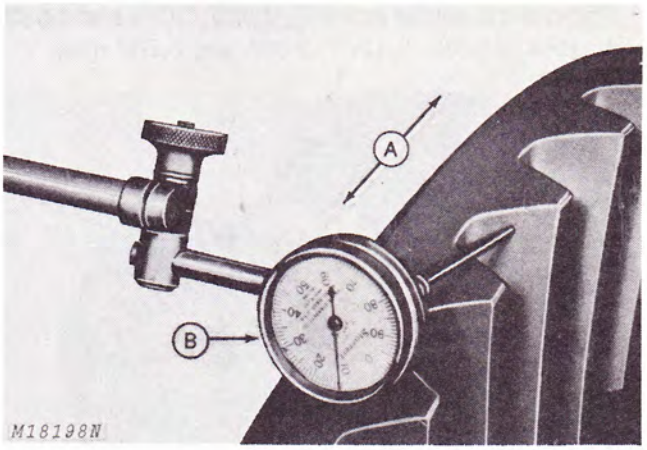
M28895

A—Bearing Caps **B—Cap Screws**

Fig. 47-Installing Bearing Caps

Install bearing caps (A, Fig. 47) in original position as previously marked. Install cap screws (B) and tighten to 40 to 45 ft-lbs (54 to 61 Nm) torque.

Adjusting Ring Gear and Pinion

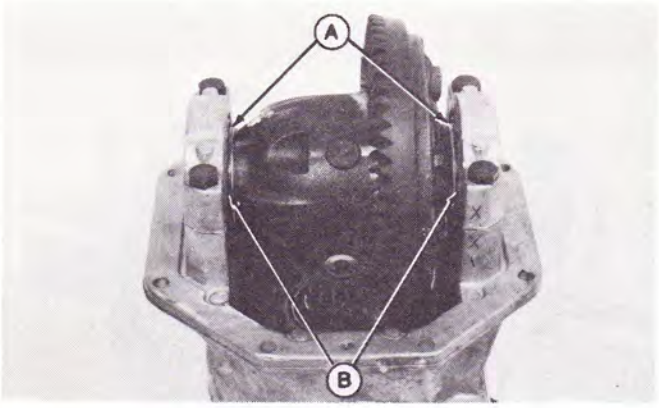


M18198N

A—Backlash **B—Dial Indicator**

Fig. 48-Checking Ring Gear and Pinion Backlash

Use dial indicator (B, Fig. 48) and check ring gear backlash (A). Ring gear backlash should be 0.003 to 0.007 inch (0.0762 to 0.1778 mm).



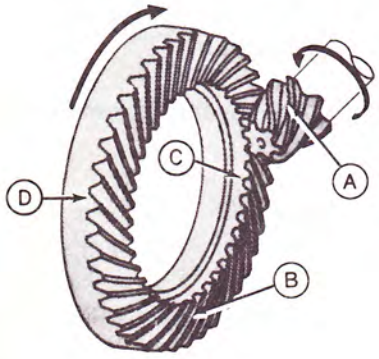
M2889G

A—Shims **B—Bearings**

Fig. 49-Correcting Backlash

If backlash is not in range given, move shims (A, Fig. 49), behind bearings (B), from one side to the other until correct backlash is attained.

NOTE: When a new differential case is installed, additional shims may be required.



18139H

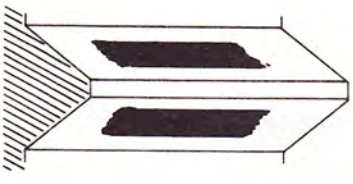
M18199

A —Pinion Gear **C —Toe (Inside)**
B —Ring Gear **D —Heel (Outside)**

Fig. 50-Ring Gear and Pinion (Typical)

Paint teeth of ring and pinion gear with gear pattern compound. Rotate pinion gear (A, Fig. 50) until ring gear (B) has made one complete revolution.

Study pattern observed and correct as needed.

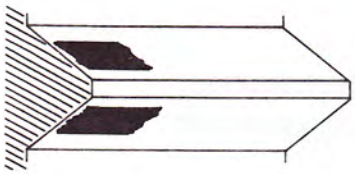


M 9207

M9207

Fig. 51-Preferred Pattern

This is the preferred pattern, Fig. 55 on both sides of ring gear tooth.
gear tooth.

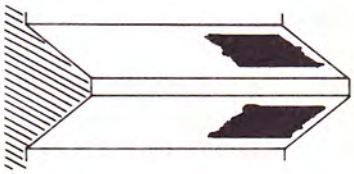


M 9208

M9208

Fig. 52-Toe Pattern

To move TOE pattern, Fig. 52, toward HEEL (D, Fig. 50), increase backlash within 0.003 to 0.007 inch (0.0762 to 0.1778 mm) limits by shimming ring gear away from pinion gear.



M 9209

M9209

Fig. 53-Heel Pattern

To move HEEL pattern, Fig. 53, toward TOE (C, Fig. 50), decrease backlash within 0.003 to 0.007 inch (0.0762 to 0.1778 mm) limits by shimming ring gear toward pinion gear.

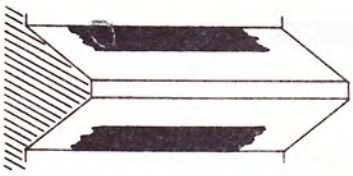


Fig. 54-Deep Pattern

To correct a deep pattern, Fig. 54, on ring gear, reduce shim pack thickness under inner pinion bearing cup.

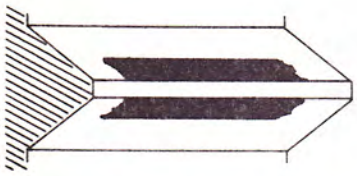


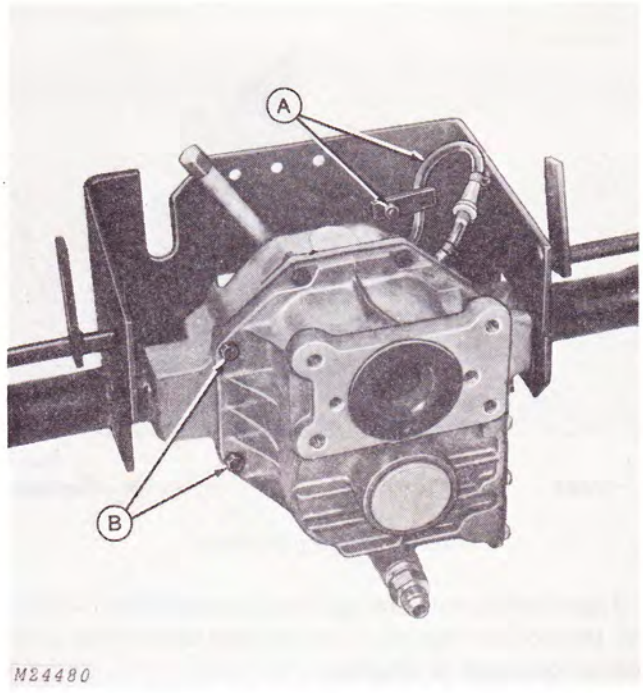
Fig. 55-Shallow Pattern

To correct a shallow pattern, Fig. 55, on ring gear, increase shim pack thickness under inner pinion bearing cup.

Assembling Case Halves

Install a new gasket between case halves for tractors with Serial No. below 155,000 and on 314 Tractors with Serial No. 155,229 through 155,340.

On the 314 Tractors with Serial No. 155,001 through 155,228 and 155,341 and above, apply an even coat of John Deere M64850 Silicon Rubber Adhesive or equivalent on sealing surface of differential case.



M24480

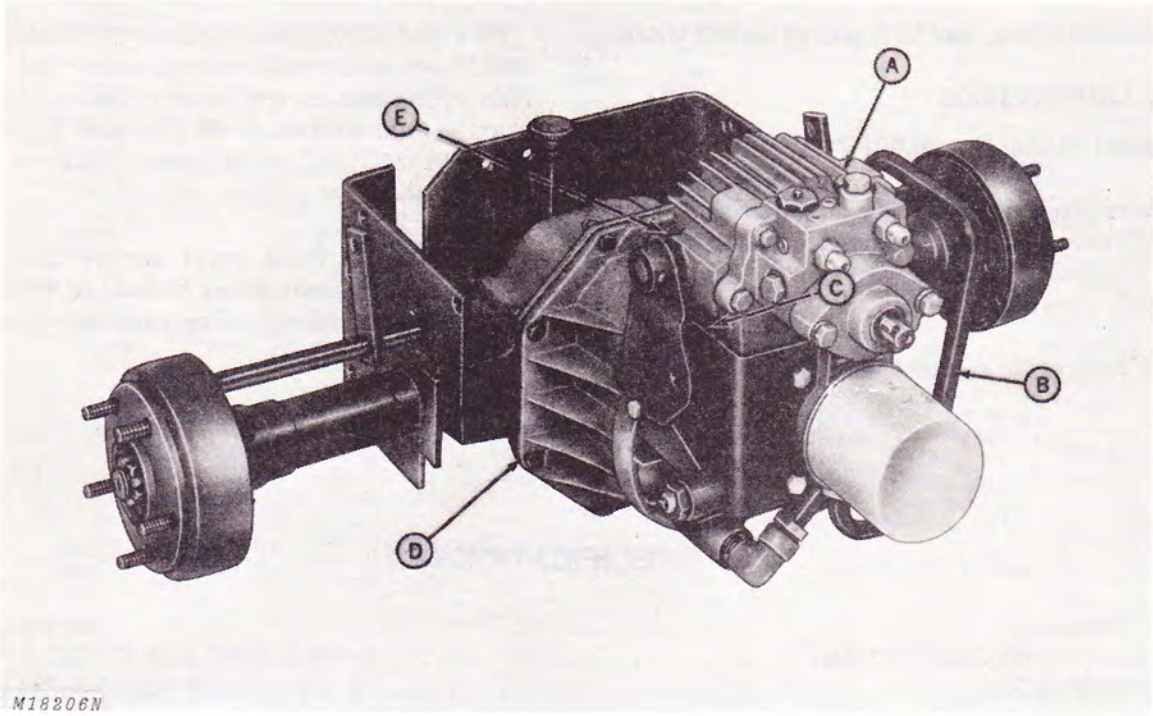
A—Sight Tube **B—Cap Screws, Lock Washers, and Nuts**

Fig. 56-Assembling Case Halves

Assemble case halves with cap screws, lock washers and nuts (B, Fig. 56). Tighten cap screws to 18 to 23 ft-lbs (24 to 31 Nm) torque.

Install sight tube (A) and tighten cap screw.

INSTALLING REAR AXLE



A—Hydrostatic Transmission
B—Axle-to-Transmission Cooling Tube
C—Spacer
D—Housing Gasket
E—Gasket

Fig. 57-Installing Rear Axle Assembly

NOTE: Gasket (D, Fig. 57) not used on 314 Tractor equipped with axle and differential (AM 38462).

Position a new housing gasket (D) between front and rear axle housings and install eight housing cap screws. Tighten cap screws to 18 to 23 ft-lbs (24.390-31.165 Nm) torque.

Install new gasket (E) between hydrostatic transmission (A) and axle housing. Install four mounting cap screws and spacers (C). The 3/8 x 5½ inch cap screws are used in the top mounting holes and the 3/8 x 4¾ inch cap screws in the bottom mounting holes. Tighten cap screws to 25 to 30 ft-lbs (33.875-40.650 Nm) torque.

Install axle-to-transmission cooling tube (B).

IMPORTANT: Tighten rear axle-to-tractor frame cap screws to 85 ft-lbs (115 Nm) torque.

Attach wheels to axle, and roll assembly into tractor frame. Insert hitch plate cap screws and tighten securely. Position mounting brackets and attach to frame sides and transmission mounting cap screws.

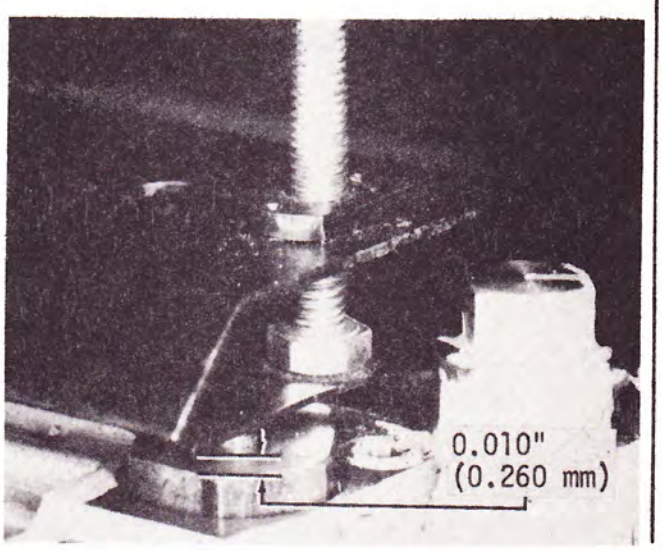


Fig. 58-Free-Wheeling Valve Spring Plate Clearance

Install fan shields, fan, and drive shaft to transmission. Using a feeler gauge, check clearance between free-wheeling valve spring plate on top fan shield and plungers of check valves. Provide clearance of 0.010 inch (0.260 mm) minimal between top of cap and bottom of spring plate, Fig. 58.

Attach control cam linkage. Refer to page 50-20-8 for the correct procedure.

Install fender-deck, fuel tank and all control knobs.

Filling Transmission

300 Tractor (Serial No. 30,001-71,160)

Fill transmission with Automatic Transmission Fluid, Type "F". With hydrostatic control lever in neutral and engine stopped, check fluid level. Fill to "FULL" mark on dipstick. See page 10-15-2.

Adjust hydrostatic control linkage, page 50-20-11.

300 Tractor (Serial No. 71,161-80,000) 312, 314 and 316 Tractors

Fill transmission with John Deere All Weather Hydrostatic Fluid or Automatic Transmission Fluid, Type "F". With hydrostatic control lever in neutral and engine stopped, add oil through fill tube until it is ¼ to 1¼ inches (5 to 30 mm) above bottom of slot in frame. See page 10-15-2.

IMPORTANT: Fluid must always be ¼ to 1¼ inches (5 to 30 mm) above bottom of slot in frame. Tractor engine must not be running when adding fluid.

SPECIFICATIONS

Component	Tolerance
Ring Gear-to-Pinion Gear Backlash	0.003 to 0.007 inch (0.0762-0.1778 mm)
Pinion Gear End Play	0.000 to 0.005 inch (0.000-0.1270 mm)

HARDWARE TORQUE

Location	Torque
Front-to-Rear Housing	18 to 23 ft-lbs (24.390-31.165 Nm)
Transmission-to-Rear Axle	25 to 30 ft-lbs (33.875-40.650 Nm)
Differential Bearing Caps	40 to 45 ft-lbs (54.200-60.975 Nm)
Ring Gear to Differential Case	50 to 55 ft-lbs (67.750-74.525 Nm)
Hub to Axle Shaft	35 to 40 ft-lbs (47.425-54.200 Nm)
Oil Seal	25 to 30 ft-lbs (33.875-40.650 Nm)
Rear axle-to-tractor frame	85 ft-lbs (115 Nm)

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Section 60
HYDRAULIC SYSTEM
Group 5
GENERAL INFORMATION

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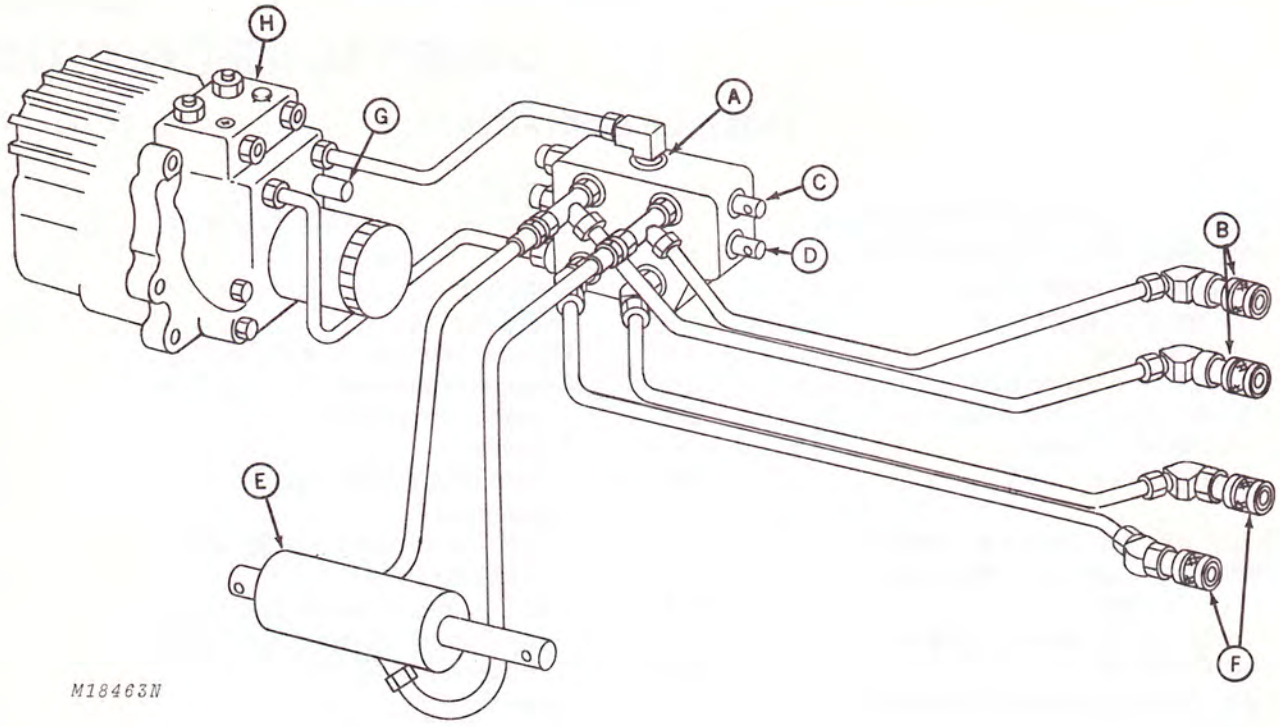
DESCRIPTION—300 AND 316 TRACTORS



A—Control Valve
B—Left Front Outlets
C—Outer Lever
D—Inner Lever
E—Rockshaft Cylinder
F—Right Front Outlets
G—Charge Pump
H—Hydrostatic Transmission

Fig. 1-Hydraulic System Components

The 300 and 316 Tractor has an open-center H-2 hydraulic system used to lift and lower tractor attachments.

In the open-center position (neutral), the implement control valve (A) allows fluid to flow freely from the hydrostatic charge pump (G) through the valve to the reservoir in the transaxle (not illustrated).

Operation of the hydrostatic unit is discussed in full in Section 50, Group 15.

The implement circuit consists of the following components:

Implement Control Valve

The control valve (A) has two spools. The left front outlets (B) and the rockshaft cylinder (E) are controlled by the upper spool operated with the outer lever (C).

The lower spool controls the right front outlets (F) and has a "float position" when the inner lever (D) is in the full forward position.

Rockshaft Cylinder

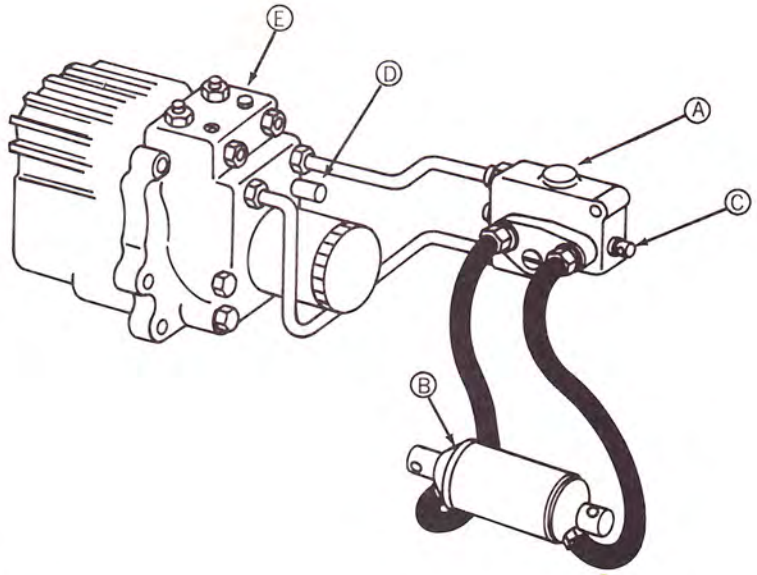
The rockshaft cylinder (E) lifts and lowers implements by rotating the rockshaft.

Front Outlets

The quick-disconnect front outlets allow easy attachment and removal of the implement.

NOTE: 300 Tractors (Serial No. 55,001 - 70,000) are equipped with one set of front outlets. A kit is available to convert these tractors to two sets of outlets.

DESCRIPTION—312 AND 314 TRACTORS



M22379N

A—Control Valve **B—Rockshaft Cylinder** **C—Lever** **D—Charge Pump** **E—Hydrostatic Transmission**

Fig. 2-Hydraulic System Components

The 312 and 314 Tractors have an open-center H-1 hydraulic system used to lift and lower the mower and tiller.

NOTE: 314 Tractors Serial No. 120,001 and above are equipped with one set of front outlets as regular equipment. See page 60-10-4, Fig. 4.

In the open-center position (neutral), the implement control valve (A) allows fluid to flow freely from the hydrostatic charge pump (D) through the valve to the reservoir in the transaxle (not illustrated).

Operation of the hydrostatic unit is discussed in full in Section 50, Group 15.

The implement circuit consists of the following components:

Implement Control Valve

The control valve (A) has one spool which controls the rockshaft cylinder (B).

Rockshaft Cylinder

The rockshaft cylinder (B) lifts and lowers attachments by rotating the rockshaft (not illustrated).

Front Outlets

A front hydraulic outlet kit, page 60-10-4, is available as an accessory for all 312 Tractors and 314 Tractors (Serial No. 95,001-120,000). Installation of this kit permits using such attachments as the front blade and snow thrower. One set of front outlets is regular equipment on 314 Tractors Serial No. 120,001 and above.

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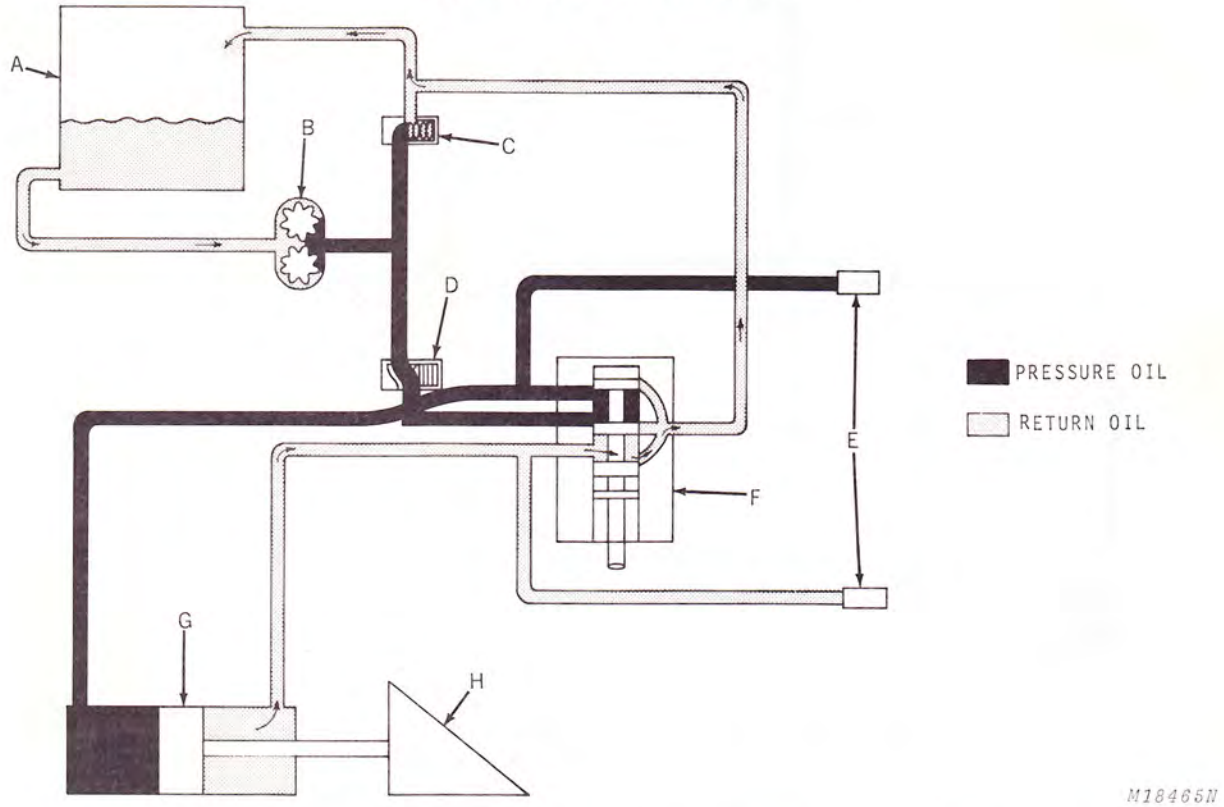
Group 10
HYDRAULIC CIRCUIT

PRINCIPLE OF OPERATION— 300 AND 316 TRACTOR



A—Reservoir
B—Charge Pump
C—Implement Relief Valve
D—Charge Relief Valve
E—Front Couplers
F—Control Valve
G—Rockshaft Cylinder
H—Load

Fig. 1-Hydraulic Circuit Flow Control Valve For 300 and 316 Tractor in Work Position

The implement circuit furnishes a constant flow of fluid at a pressure of 70 to 110 psi (4.8263 bar -7.5852 bar).

Oil under pressure from the fixed displacement charge pump (B) leaves the transmission through the charge relief valve (D) and outlet port to the control valve (F), Fig. 1.

When an implement control valve is activated, the normal unrestricted flow of fluid is cut-off and directed to the load (H). Pressure will build up to overcome the load, or will be relieved at the implement relief valve (C).

The implement relief valve pressure is set at approximately 500 psi (34.4735 bar). Any oil passing through the implement relief valve flows directly into the reservoir (A).

The 300 and 316 Tractor has a center-mounted cylinder (G) operating the rockshaft and two sets of front-mounted hydraulic couplers (E).

NOTE: 300 Tractors (Serial No. 55,001-70,000) are equipped with one set of front outlets. A kit is available to convert these tractors to two sets of outlets.

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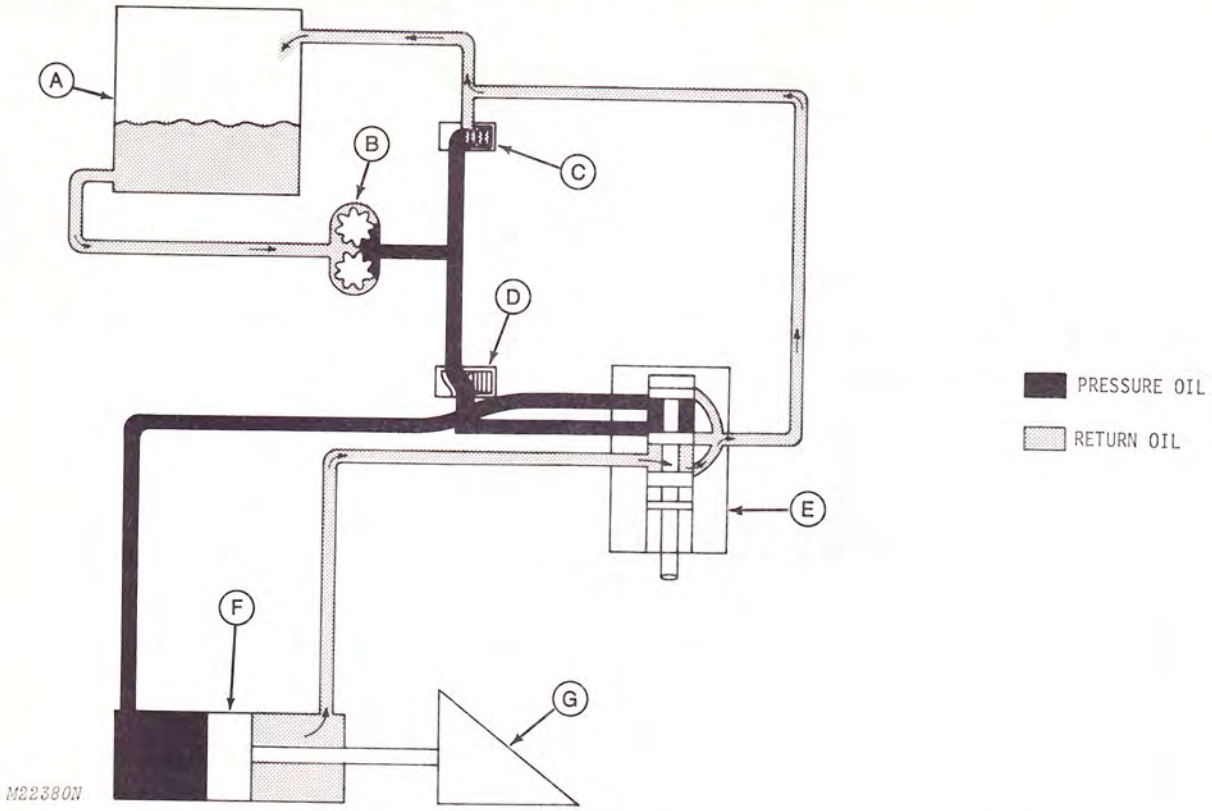
PRINCIPLE OF OPERATION— 312 AND 314 TRACTORS



A—Reservoir
B—Charge Pump
C—Implement Relief Valve
D—Charge Relief Valve
E—Control Valve
F—Rockshaft Cylinder
G—Load

Fig. 2-Hydraulic Circuit Flow Control Valve in Work Position

The implement circuit furnishes a constant flow of fluid at a pressure of 70 to 110 psi (4.8263 bar -7.5852 bar).

Oil under pressure from the fixed displacement charge pump (B) leaves the transmission through the charge relief valve (D) and outlet port to the control valve (E), Fig. 2.

When an implement control valve is activated, the normal unrestricted flow of fluid is cut-off and directed to the load (G). Pressure will build up to overcome the load, or will be relieved at the implement relief valve (C).

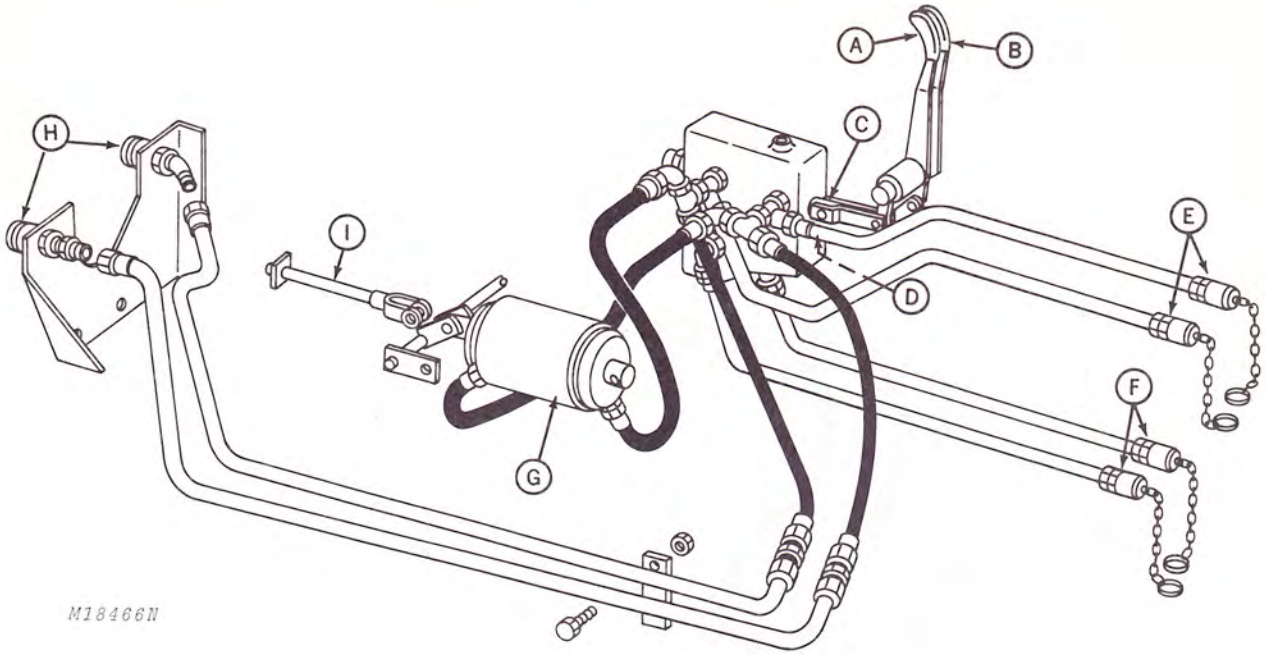
The implement relief valve pressure is set at approximately 500 psi (34.4735 bar). Any oil passing through the implement relief valve flows directly into the reservoir (A).

Model 312 and 314 Tractors have a center-mounted cylinder (F) operating the rockshaft.

NOTE: A front hydraulic outlet kit is available as an accessory for all 312 Tractors and 314 Tractors (Serial No. 95,001-120,000). Model 314 Tractors Serial No. 120,001 and above are equipped with one set of front hydraulic outlets as regular equipment. See page 60-10-4.

Litho in U.S.A.

REAR MOUNTED HYDRAULIC COUPLERS— 300 AND 316 TRACTORS



A—Inner Control Lever
B—Outer Control Lever
C—Upper Spool Valve
D—Lower Spool Valve
E—Left Front Couplers
F—Right Front Couplers
G—Rockshaft Cylinder
H—Rear Hydraulic Couplers
I —Lock-Out Link

Fig. 3-300 and 316 Tractor Hydraulic System with Rear-Mounted Couplers

The 300 and 316 Tractor can be equipped with rear-mounted hydraulic couplers (H), Fig. 3.

The rear couplers (H) may be connected to either the upper or lower spool valves.

The upper spool valve (C) operated with the outer control lever (B), controls the left front couplers (E) and the rockshaft cylinder (G), Fig. 3.

The lower spool valve (D) operated with the inner control lever (A), controls the right front couplers (F), Fig. 3. The lower spool valve also has a built-in float position.

When the rear hydraulic couplers (H) are connected to the upper spool valve (C), a lock-out link (I) is required to provide instantaneous action when using the front or rear-mounted implements.

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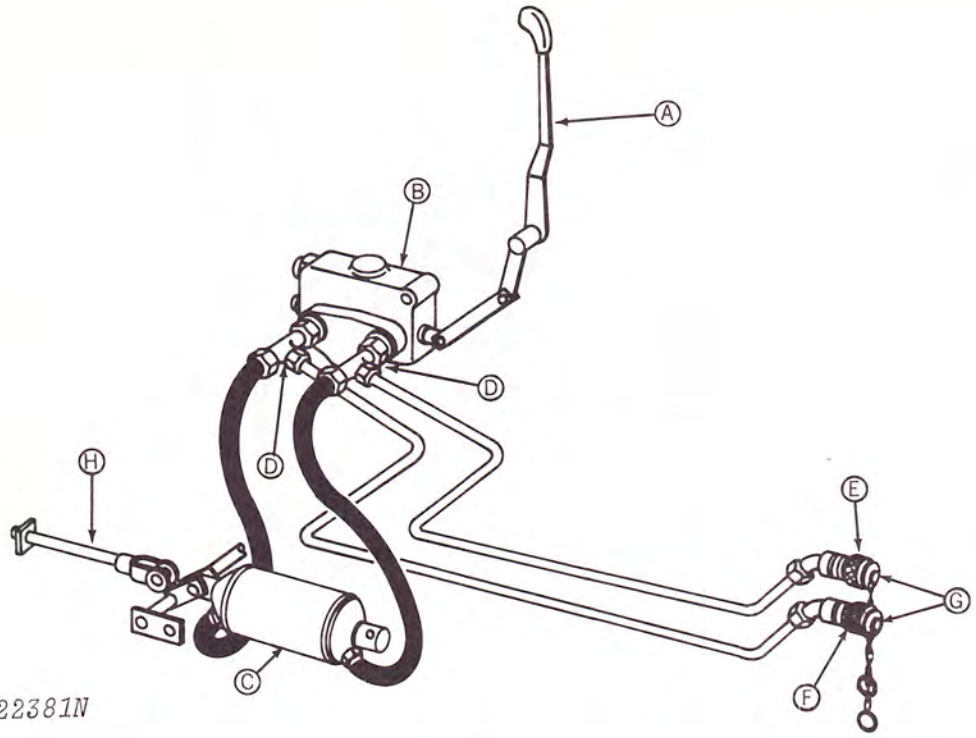
FRONT HYDRAULIC OUTLETS—312 AND 314 TRACTORS



A—Control Lever
B—Control Valve
C—Rockshaft Cylinder
D—Tee Fittings
E—Upper Right Front Outlet
F—Lower Right Front Outlet
G—Front Couplers
H—Lock-Out Link

Fig. 4-312 and 314 Tractor Front Hydraulic Outlets

All 312 Tractors and 314 Tractors (Serial No. 95,001-120,000) can be equipped with a set of right-hand front hydraulic outlets (E) and (F), Fig. 4, as extra equipment.

NOTE: 314 Tractors, Serial No. 120,001 and above, are equipped with one set of front hydraulic outlets, Fig. 4, as regular equipment.

The front hydraulic outlets permit using the snow thrower and front blade attachments as well as allied equipment which is front-mounted.

The hydraulic outlet tubes are attached to the control valve (B) with tee fittings (D).

The rockshaft cylinder (C) operates in conjunction with the front hydraulic outlets.

The control lever (A) operates the rockshaft cylinder (C) and both front outlets (E) and (F) simultaneously.

Attachment hydraulic cylinder hoses can be connected quickly to the two quik-disconnect front couplers (G).

A lock-out link (H) is required to provide instantaneous action when using front-mounted attachments.

ANALYSIS

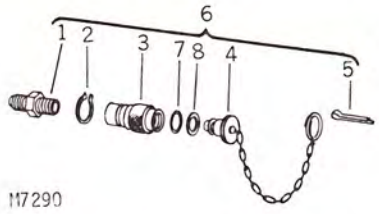
Analysis of failed parts affecting the operation of the hydraulic system can be found on page 50-15-11 under "Inspection". Outside of the transmission most problems involving the hydraulic system will consists of failed O-rings, loose fittings or linkage problems.

TESTING THE HYDRAULIC SYSTEM

Complete tests for checking the hydraulic system charge pressure and implement circuit pressure are found on page 50-15-6 of Section 50.

Litho in U.S.A.

HYDRAULIC COUPLER



1—Hose Union
2—Snap Ring
3—Hydraulic Coupler
4—Rubber Dust Plug
5—Cotter Pin
6—Hydraulic Kit
7—O-Ring
8—Backup Washer

Fig. 5-Hydraulic Coupler

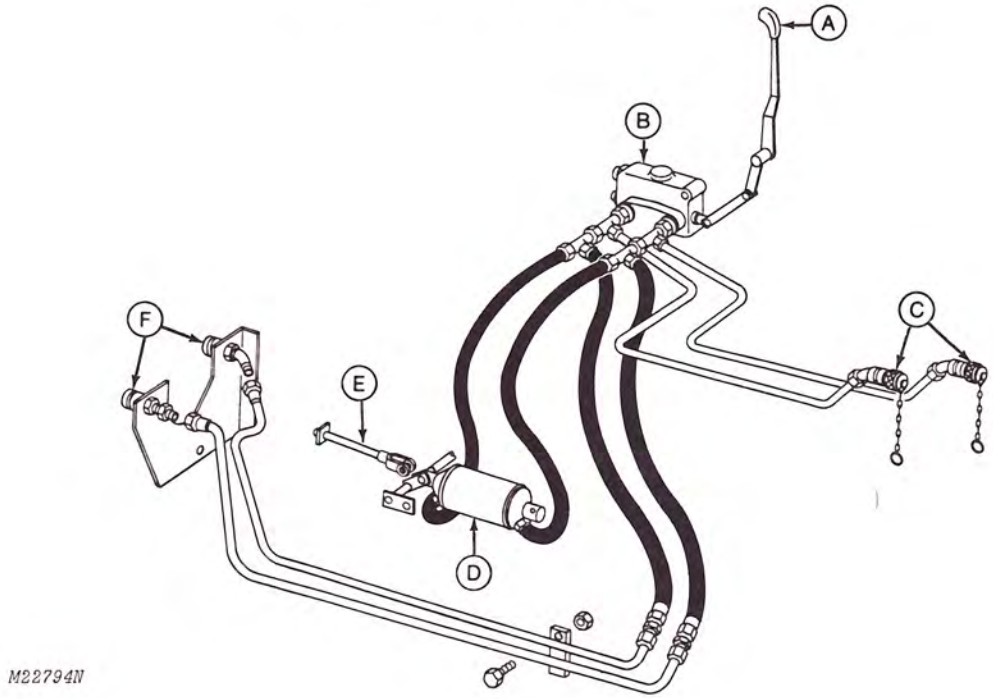
If leakage occurs at the hydraulic couplers, remove coupler and inspect it for damaged O-rings, dirt or scoring.

Whenever couplers are removed from tractor, plug lines to prevent entrance of dirt. Also advise customers that they should always install dust plugs and dust caps when the coupler is uncoupled.

Do not attempt to repair coupler by removing inside ball checks and seats. These parts have been factory assembled to very close tolerances and should be repaired only at the factory.

Replace O-ring, Figure 5, and reinstall coupler using sealing compound on the male threads.

REAR HYDRAULIC OUTLETS (EXTRA EQUIPMENT) 312 AND 314 TRACTORS



A—Control Lever
B—Control Valve
C—Front Couplers
D—Rockshaft Cylinder
E—Lock-Out Link
F—Rear Couplers

Fig. 6-312 and 314 Tractors Rear Hydraulic Outlets

The 312 and 314 Tractors can be equipped with rear hydraulic outlets to accommodate the use of the 3-point hitch or other allied equipment.

A lock-out link (E) is required to provide instantaneous action when using rear-mounted equipment.

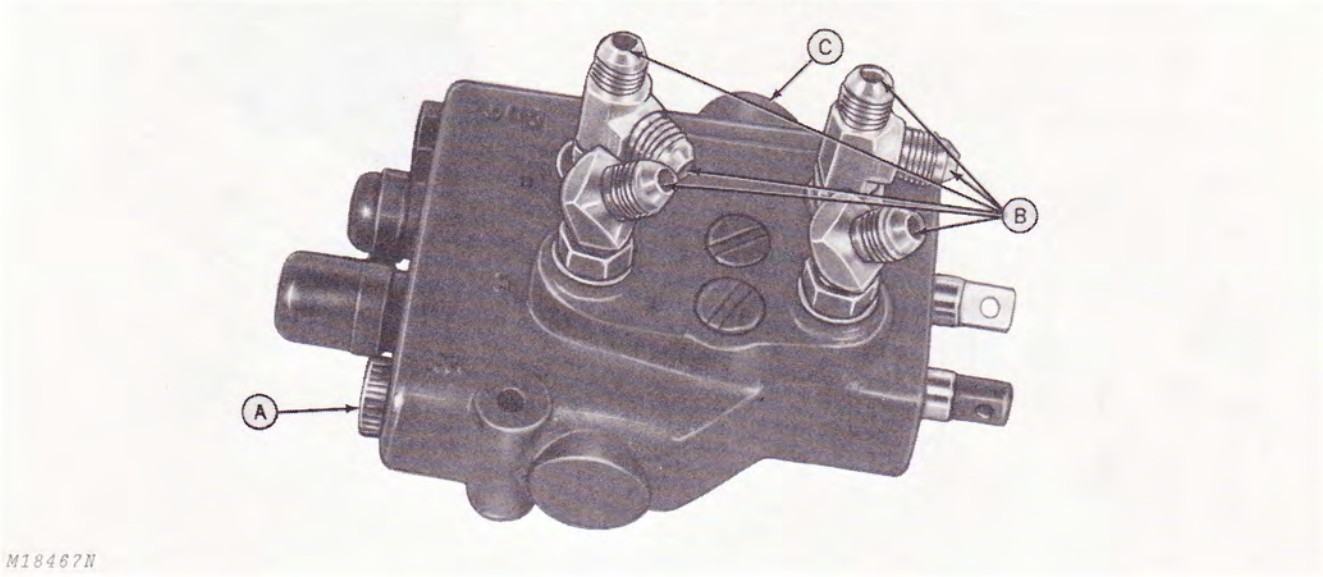
DIAGNOSING MALFUNCTIONS

Problem	Cause	Remedy
Little or no lift power.	Fluid low in system.	Fill to proper level.
	Improper viscosity oil.	Change oil.
	Plugged filter.	Change filter.
	Insufficient engine speed.	Increase engine speed.
	Broken implement line.	Replace line.
	Low charge pressure.	Check drive shaft is turning charge pump. Check charge pump.
	Implement relief valve faulty.	Change relief valve.
	Damaged linkage.	Straighten or repair linkage.
System overheats.	Fluid low in system.	Fill to proper level.
	Contaminated oil.	Change oil and filter.
	Relief valve set too high.	Replace relief valve.
	Improper oil.	Change oil.
	Hydraulic lines restricted or crimped.	Straighten or replace hydraulic lines.
	System leaks.	Check fittings and lines.
	Filter plugged.	Replace filter.
Low system pressure.	Fluid low in system.	Fill to proper level.
	Filter plugged.	Replace filter.
	Damaged lines.	Replace or repair lines.
	Weak relief valve.	Repair or replace valve.
	Worn charge pump.	Repair or replace pump.
External leakage.	Loose screws.	Tighten screws.
	Damaged O-rings.	Replace O-rings.
	Damaged lines or loose connections.	Check fittings and lines.
	Valve spool worn or damaged.	Replace control valve.
Work load lowers with spool in slow raise position.	Damaged lift check plunger.	Replace lift check plunger.
	Damaged lift check seat in body.	Replace control valve.
	Damaged O-rings.	Replace O-rings.
	Damaged lines or loose connections.	Check fittings and lines.
Work load drops with spool in neutral position.	Damaged cylinder packing.	Replace cylinder.
	Line to cylinder leaking.	Tighten or replace hose.
	Internal leakage between spool and valve body.	Replace control valve.
Valve spool sticking.	Misaligned control linkage.	Correct alignment.
	Foreign material in spool bore.	Remove spool. Clean spool and bore.

Litho in U.S.A.

Group 15
HYDRAULIC CONTROL VALVE

GENERAL INFORMATION - 300 AND 316 TRACTORS



A—Inlet Port **B—Hydraulic Outlets** **C—Return Port**

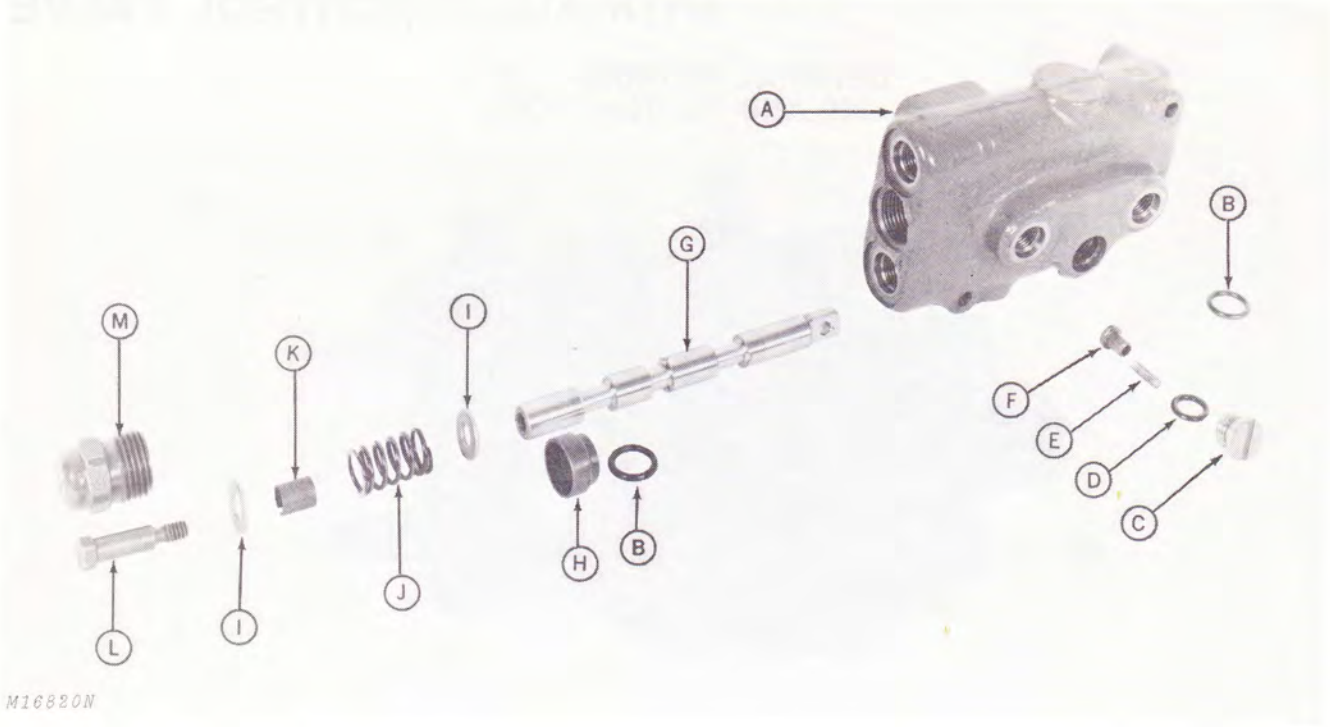
Fig. 1-H-2 Control Valve

The H-2 control valve consists of a valve body, two spools, four work ports and two lift check valves. The control valve is an open-center design, providing a continuous flow of oil from the reservoir to the transmission charge pump, the valve and back to the reservoir.

Oil flow is continuous as long as the control lever is in neutral. When a lever is moved out of neutral, a restriction is created diverting oil under pressure to the work load.

Litho in U.S.A.

GENERAL INFORMATION— 312 TRACTORS



A—Valve Body
B—O-Ring (2 used)
C—Lift Check Plug
D—O-Ring
E—Lift Check Spring
F—Lift Check Plunger
G—Spool
H—Sleeve
I —Washer (2 used
J —Spring
K—Spacer
L —Shoulder Bolt
M—Cap

Fig. 2-H-1 Control Valve Components on 312 Tractors

The H-1 control valve consists of a valve body, spool, two work ports and a lift check valve. The lift check valve prevents the load or attachment from lowering when lifted from a partially raised position. The control valve is an open-center design, in that with the lift lever in neutral position and the engine running, oil flows continuously from the reservoir to the pump through the control valve and back to the reservoir. Oil from the work ports to the cylinder is trapped, locking the cylinder in position.

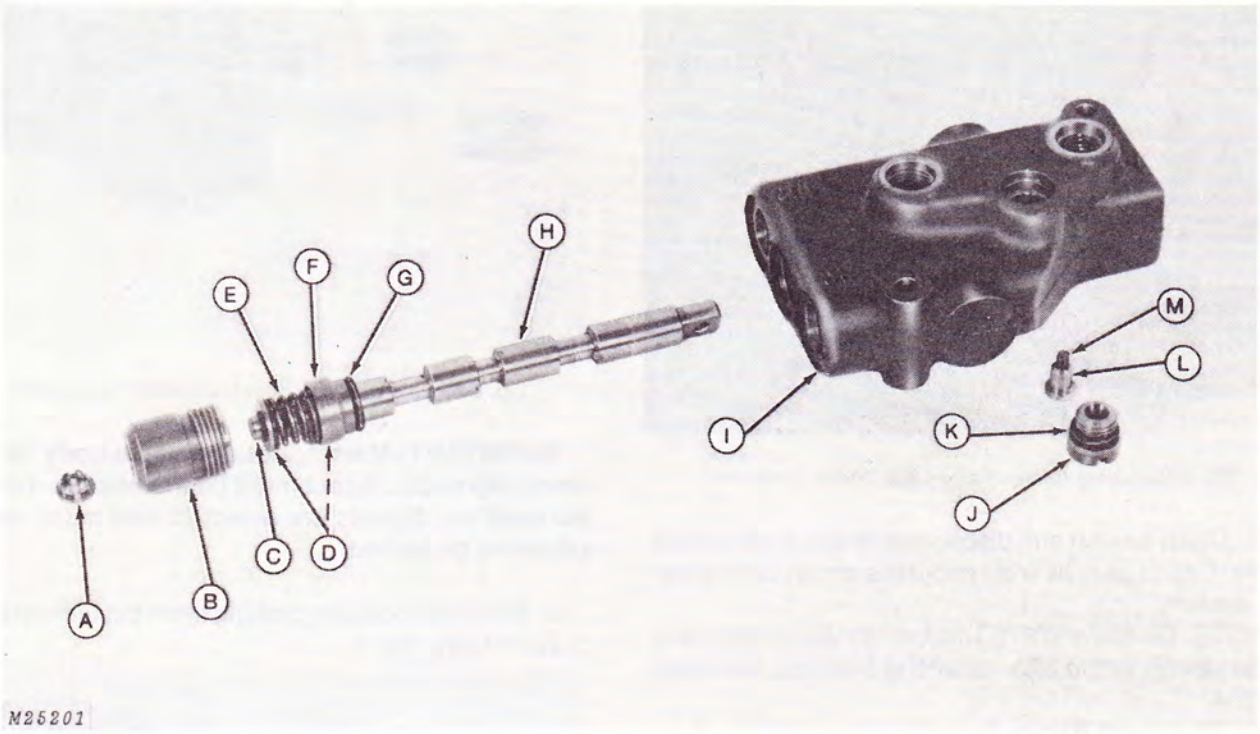
REMOVAL

Before removing and disassembling the control valve, be sure to check "Diagnosing Malfunctions" page 60-10-6 for possible causes of difficulty.

Lower equipment to the ground. With the engine stopped, move the control lever back and forth to relieve all pressure in the system.

Litho in U.S.A.

GENERAL INFORMATION - 314 TRACTORS (Serial No. 95,001-)



A—Button Plug
B—Cap
C—Retaining Ring
D—Washers (2 used)
E—Spring
F—Sleeve
G—O-Ring
H—Spool
I —Valve Body
J —Lift Check Plug
K—O-Ring
L —Plunger
M—Spring

Fig. 3-H-1 Control Valve Components for 314 Tractor Serial No. 95,001 and Above

The H-1 control valve used on 312 Tractors, Fig. 2, differs from the H-1 control valve used on 314 Tractors, Fig. 3. Both valves consist of a valve body, spool, two work ports and a lift check valve. The spool assemblies are of a different design and are not interchangeable from one valve to the other.

The lift check valve in both control valves prevents the load or attachment from lowering when lifted from a partially raised position.

Both control valves are of an open-center design. This means, that with the lift lever in neutral position and the engine running, oil flows continuously from the reservoir to the pump through the control valve and back to the reservoir. Oil from the work ports to the hydraulic cylinder is trapped, locking the cylinder in position.

REMOVAL

Before removing and disassembling the control valve, be sure to check "Diagnosing Malfunctions" page 60-10-6 for possible causes of difficulty.

Lower equipment to the ground. With the engine stopped, move the control lever back and forth several times to relieve all pressure in the system.

Removing Control Valve

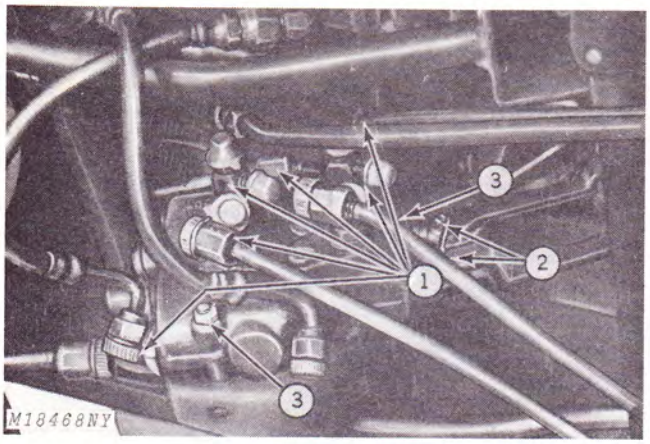


Fig. 4-Removing Control Valve - 300 Tractor Illustrated

1. Clean around and disconnect fittings from control valve. Cap or plug all lines and parts so dirt can't enter the system.

NOTE: On 300 and 316 Tractors, top fitting may have to be disconnected after mounting bolts are removed, Step 4.

2. Disconnect linkage to hydraulic control levers by removing the small cotter pins.
3. Remove two mounting bolts and remove valve.

DISASSEMBLY

H-2 Control Valve On 300 and 316 Tractors

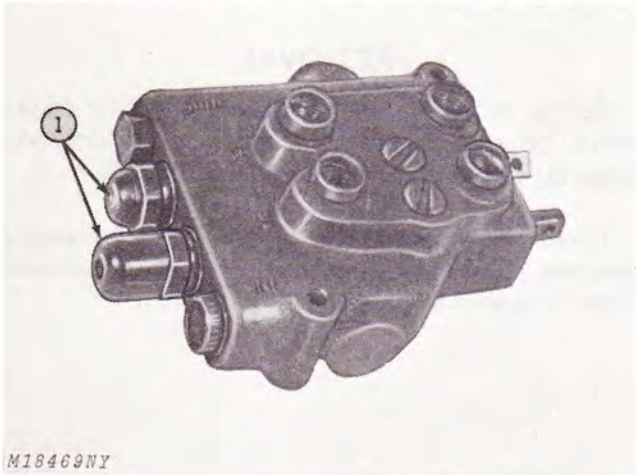


Fig. 5-Removing Spool Caps from H-2 Control Valve

Plug all ports and clean outside of valve thoroughly.

1. Remove spool caps from valve body, Fig. 5.

NOTE: When removing float spool cap (longest cap), be careful to prevent losing spring-loaded steel balls. Place a cloth over assembly to catch balls as the cap is removed.

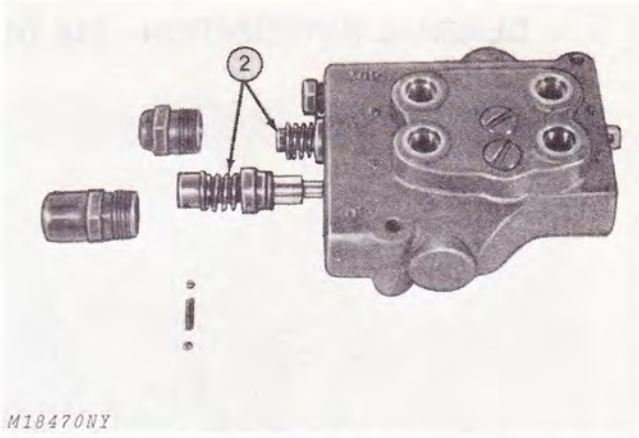


Fig. 6-Removing Spools from H-2 Control Valve Body

IMPORTANT: Mark spool and valve body before removing spool. Spool must be installed in this exact position. Spools are select-fit and must not be switched or turned.

2. Remove spools by pushing them out the cap ends of valve body, Fig. 6.

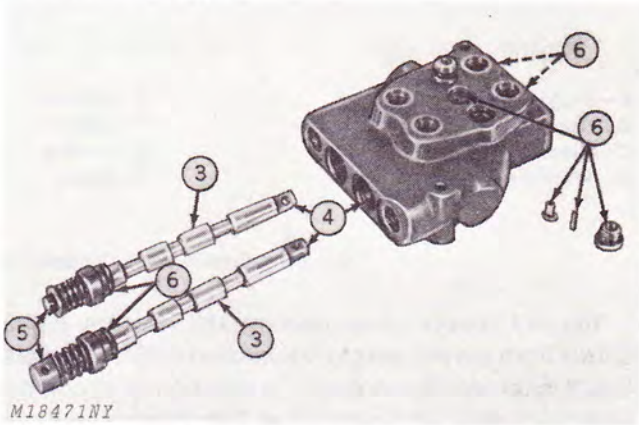


Fig. 7-Disassembling H-2 Control Valve

3. Be careful when disassembling valve so that spools are not mixed because they are select-fitted at the factory and must not be interchanged.

4. If a spool or valve body is damaged, the entire valve must be replaced.

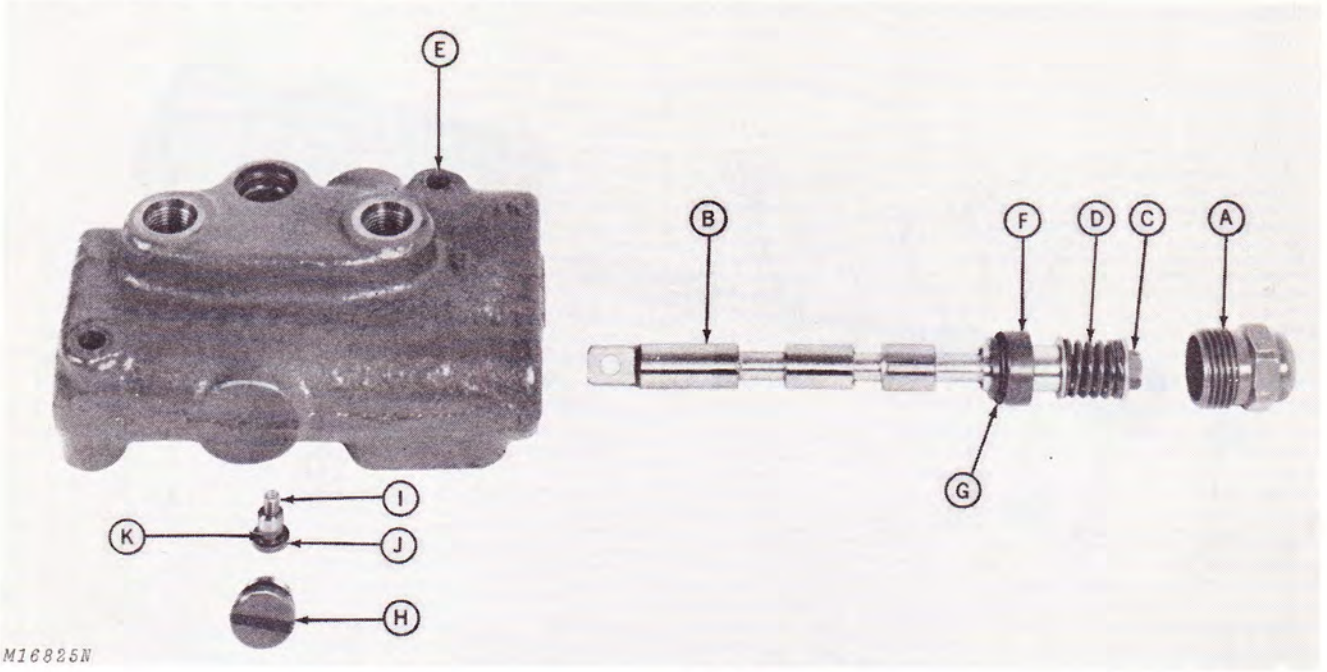
5. The spool screws are installed with Loctite. Remove screw only if a spool spring is damaged.

6. Remove lift check screw spring and lift check plunger. Remove O-rings from spool, lower end of valve bore and lift check plug.

7. Wash all parts in clean solvent.

DISASSEMBLY

H-1 Control Valve On 312 Tractors



A—Spool Cap
B—Spool
C—Cap Screw
D—Spring
E—Valve Body
F—Sleeve
G—O-Ring
H—Lift Check Plug
I —Lift Check Spring
J —Plunger
K—O-Ring

Fig. 8-Removing Spool and Lift Check Plug from H-1 Control Valve used On 312 Tractors

Plug all ports and clean outside of valve thoroughly.

IMPORTANT: Mark spool (B, Fig. 8) and valve body (E) before removing spool. Spool must be installed in this exact position. Spool is a select-fit and must not be turned.

Remove the spool cap (A) and spool (B). Do not remove the cap screw (C) unless the spring (D) needs to be replaced. The spring need not be replaced unless it is broken.

Remove the spool (B) from the valve body (E).

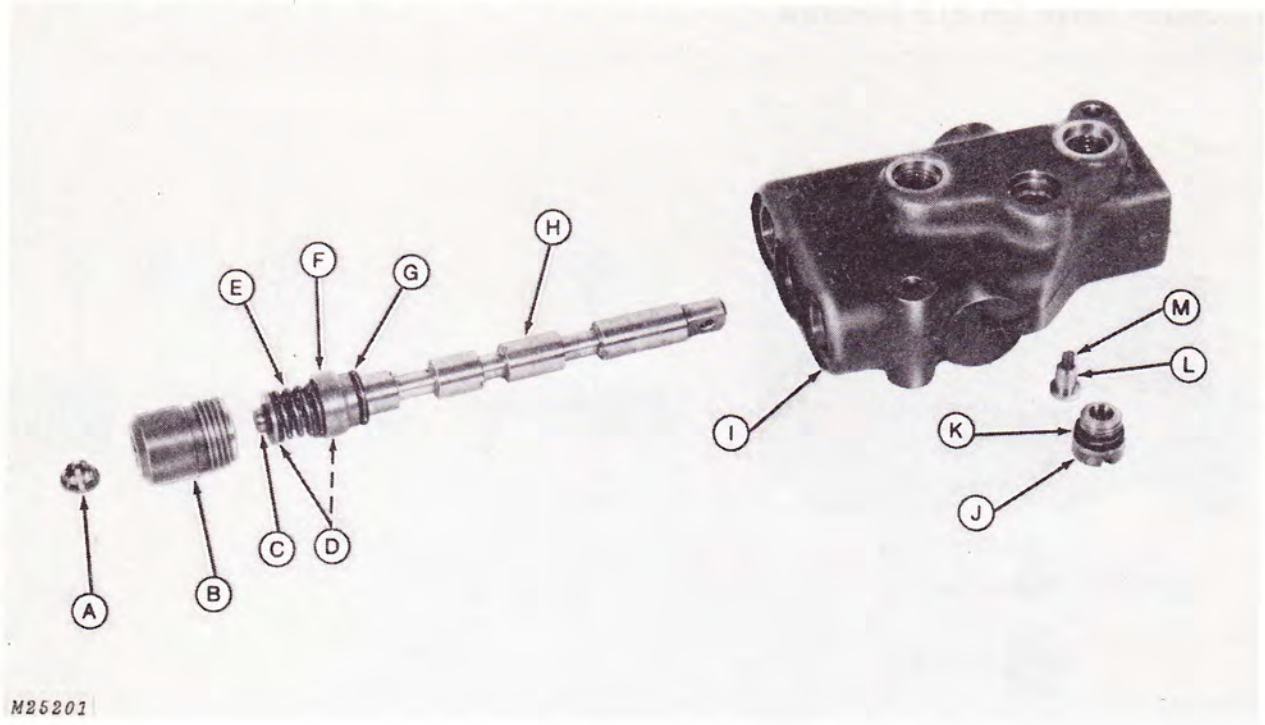
NOTE: Spool (B) and valve body (E) are matched sets. If one is damaged, both must be replaced.

Remove the sleeve (F) and O-ring (G) from the spool (B).

Remove lift check plug (H), spring (I) and plunger (J) from the valve body. Remove the O-ring (K) from the plug (H).

Remove O-ring from control valve body, Fig. 10, using a small wire or paper clip. Discard all O-rings.

H-1 Control Valve on 314 Tractors Serial No. 95,001 and Above



A—Button Plug
B—Cap
C—Retaining Ring
D—Washers (2 used)
E—Spring
F—Sleeve
G—O-Ring
H—Spool
I —Valve Body
J —Lift Check Plug
K—O-Ring
L —Plunger
M—Spring

Fig. 9-Removing Spool Assembly and Lift Check Plug from H-1 Control Valve Used on 314 Tractors Serial No. 95,001 and Above

Plug all ports and clean outside of valve thoroughly.

Remove button plug (A), Fig. 9, and spool cap (B) with an Allen wrench.

IMPORTANT: Mark spool (H) and valve body (I) before removing spool. Spool must be installed in this exact position. Spool is a select-fit and must not be turned.

Push spool assembly (H) out of valve body (I). Do not remove retaining ring (C) or spring (E) unless the spring is broken.

NOTE: Spool and valve body are matched sets. If one is damaged, both must be replaced.

Remove sleeve (F) and O-ring (G) from spool.

Remove lift check plug (J), spring (M) and plunger (L) from valve body. Remove O-ring (K) from plug (J).

Remove O-ring from control valve body, Fig. 10, using a small wire or paper clip. Discard all O-rings.

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Fig. 10-Removing O-Ring from Valve Body

INSPECTION

Remove all nicks and burrs from ports and inspect the spool and valve body for excessive wear, Figs. 8 and 9. Inspect the spool spring and lift check spring for breakage.

Do not inspect O-rings. Replace them.

REPAIR

Inspect all parts thoroughly. All parts are serviceable except the spools and valve bodies which must be replaced together.

Remove burrs and slight scratches from spool and valve bore with fine emery cloth.

Smooth up lift check seat with fine emery cloth if necessary.

If the screw in the end of the spool has been removed, clean Loctite from threads. Thoroughly clean all parts and oil them lightly prior to assembly.

ASSEMBLY

Thoroughly clean and dry all parts. Metal parts should be lightly oiled prior to assembly.

IMPORTANT: Install all new O-rings.

H-1 Control Valve on 312 Tractors

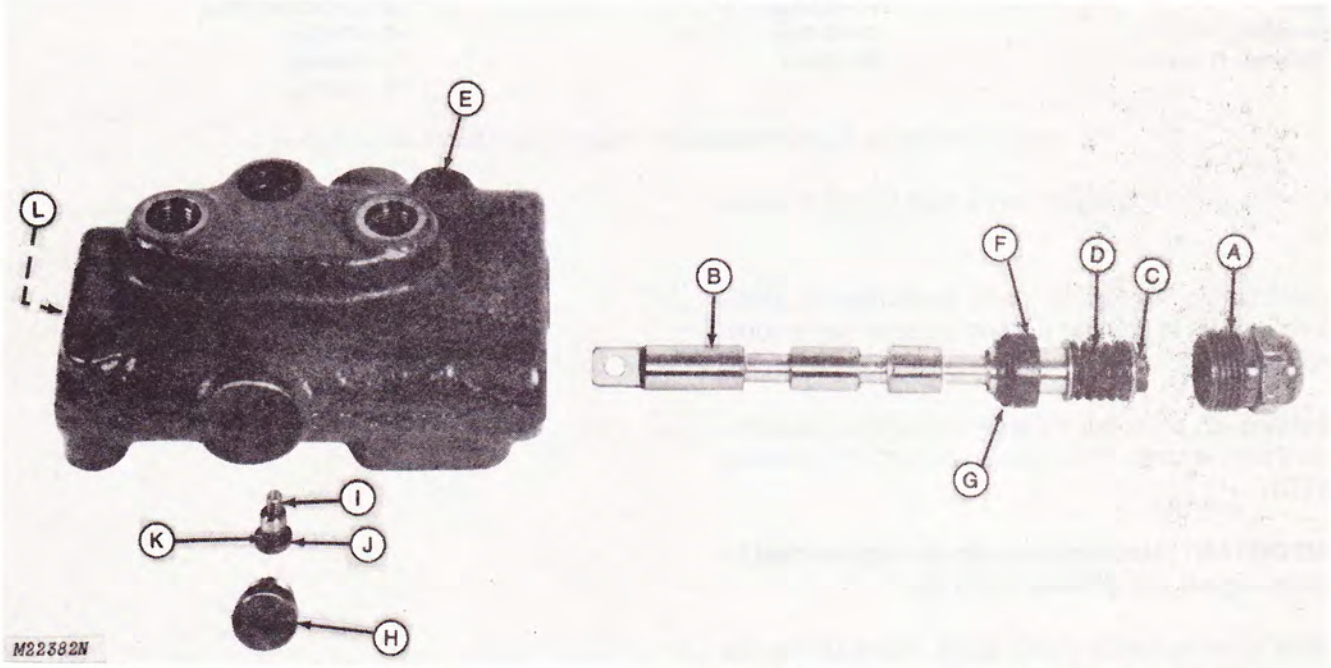
Refer to Fig. 11 and position new O-ring in spool bore (L).

Install O-ring (K) on lift check plunger (J). Position spring (I) on plunger (J) and place in valve body (E). Install plug (H).

If spring (D) on spool (B) was removed for replacement, cap screw (C) should be installed with Loctite and tightened to 5 to 8 ft-lbs torque (6.8 to 10.8 Nm).

IMPORTANT: Use marks made during removal to position spool (B) in valve body (E).

Slide spool sleeve (F) over spool (B). Place O-ring (G) over spool and position it on sleeve (F). Dip spool in clean oil and insert spool and spring assembly into valve body. Install spool cap (A) to secure spool assembly in valve.

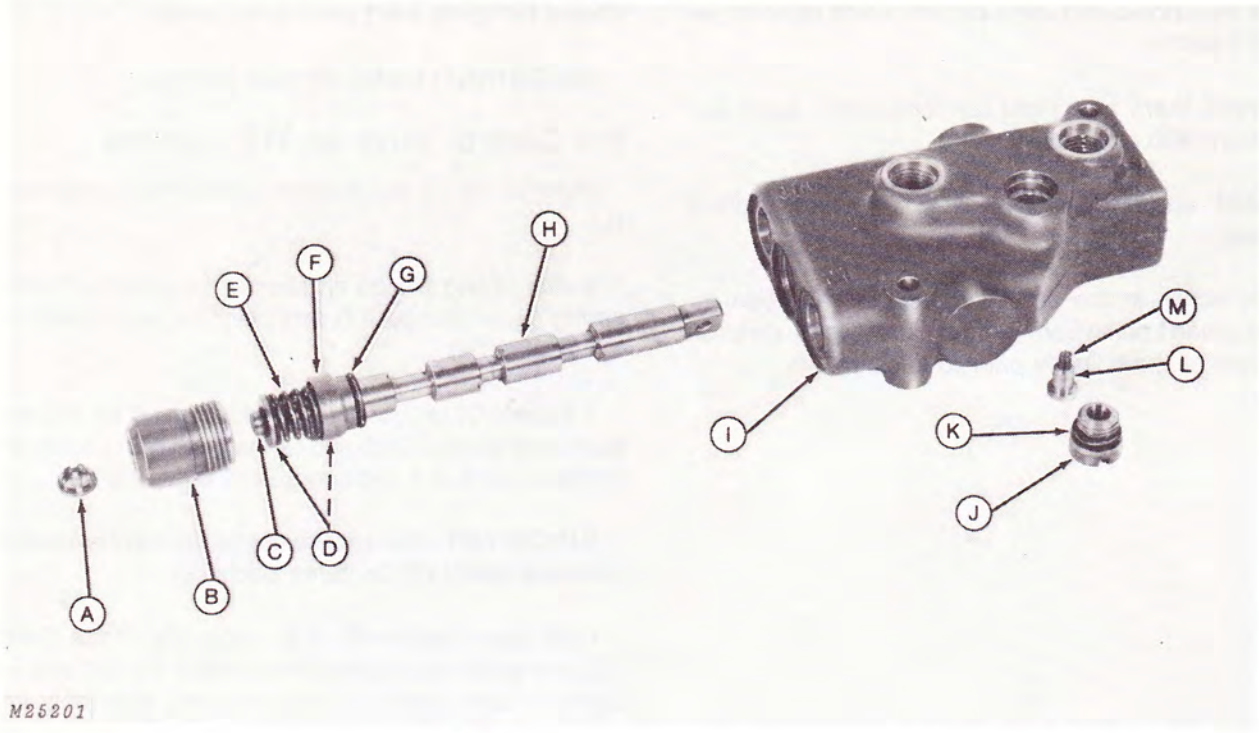


A—Spool Cap
B—Spool
C—Cap Screw
D—Spring
E—Valve Body
F—Sleeve
G—O-Ring
H—Lift Check Plug
I —Lift Check Spring
J —Lift Check Plunger
K—O-Ring
L —Spool Bore

Fig. 11-Assembling H-1 Control Valve Used on 312 Tractors

ASSEMBLY—Continued

H-1 Control Valve on 314 Tractors Serial No. 95,001 and Above



A—Button Plug
B—Cap
C—Retaining Ring
D—Washers (2 used)
E—Spring
F—Sleeve
G—O-Ring
H—Spool
I —Valve Body
J —Lift Check Plug
K—O-Ring
L —Plunger
M—Spring

Fig. 12-H-1 Control Valve Assembly Used on 314 Tractors Serial No. 95,001 and Above

Refer to Fig. 10 and position a new O-ring in spool bore.

Install O-ring (K), Fig. 12, on lift check plug (J). Position spring (M) in plunger (L) and place in valve body. Install plug (J).

If spring (E) on spool (H) was removed for replacement, install washer, new spring, washer and retaining ring (C).

IMPORTANT: Use marks made during removal to position spool (H) in valve body (I).

Slide spool sleeve (F) over spool. Place O-ring (G) over spool and position it on sleeve. Dip spool assembly in clean oil and insert into valve body. Install spool cap (B) and button plug (A).

ASSEMBLY—Continued

H-2 Control Valve on 300 and 316 Tractors

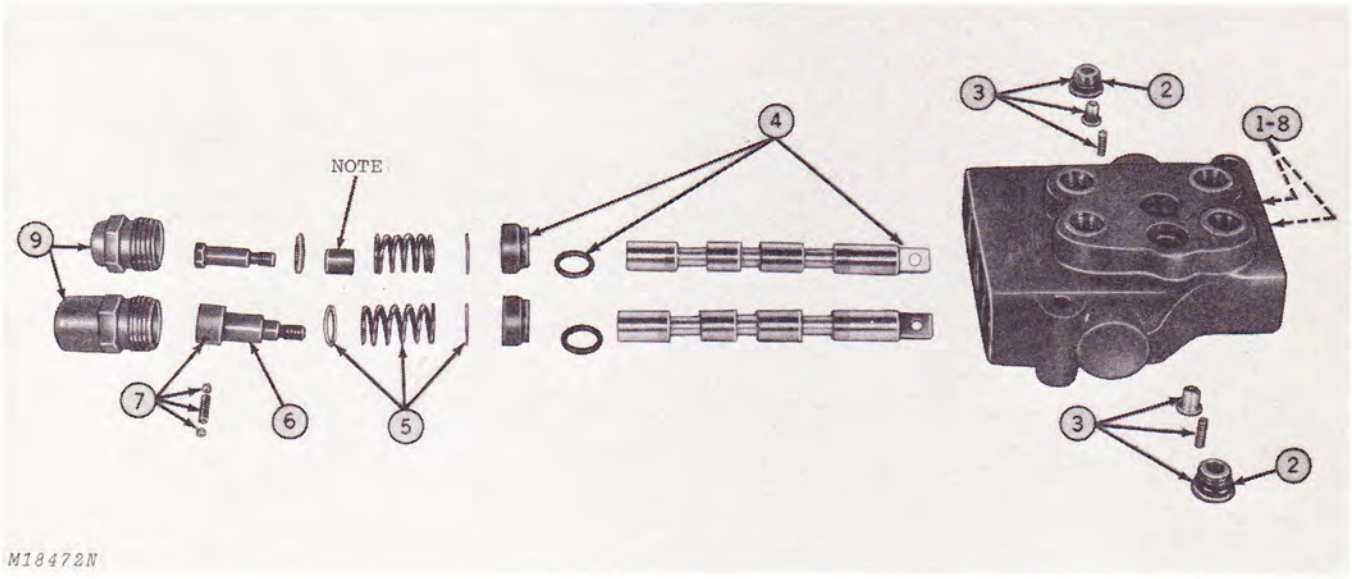


Fig. 13-Assembling H-2 Control Valve

1. Install new O-ring in spool body, Fig. 13.

2. Install new O-ring on lift check plug.

3. Install lift check plunger and lift check spring in valve body and secure with lift check plug. Tighten plug securely.

4. Place end of spool with flat side in vise and slide new O-ring on spool, Fig. 13. Then slide bushing on spool.

5. Slip steel washer, spring and another steel washer on spool.

NOTE: On spool without detent, a spool spacer must be installed between the two steel washers. Springs are of different lengths.

6. Apply Loctite to spool screw threads and screw tightly into spool.

7. When installing spool with detent, install spring into screw hole and push steel balls into hole while slipping cap over balls.

IMPORTANT: Use marks made during removal to position spool in valve body.

8. Grease lower O-ring in valve body and slowly insert spool into valve body.

9. Tighten cap slightly but not so tight as to bind the spool.

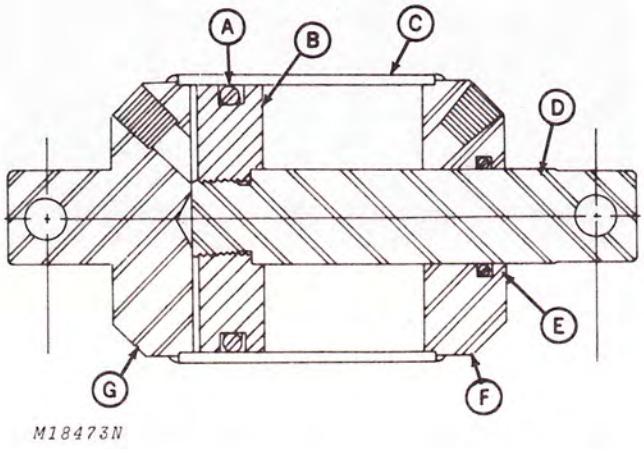
INSTALLATION

Attach valve to its proper mounting bracket using the two 1/4-inch bolts. Connect the linkage from the hydraulic control levers to the valve spools. Remove the caps and plugs from the fittings and lines.

Install sealing compound on fittings. Attach hydraulic lines to the proper fittings. See Fig. 4, page 60-15-4, and tighten securely.

Group 20
HYDRAULIC CYLINDER

GENERAL INFORMATION



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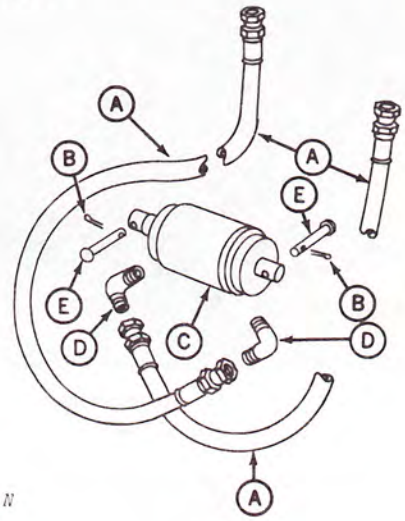
A—O-Ring
B—Piston
C—Barrel
D—Piston Rod
E—O-Ring
F—Bearing
G—Head

Fig. 1-Cutaway View of Rockshaft Cylinder



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A—Hydraulic Hoses
B—Cotter Pin
C—Rockshaft Cylinder
D—90° Elbow
E—Cylinder Pin

Fig. 2-Exploded View of Cylinder

The rockshaft cylinder is a double-acting cylinder connected to the control valve with two flexible high-pressure hoses.

Slots in the linkage prevent the cylinder from exerting downward force on the tractor lift linkage for rockshaft-mounted equipment allowing equipment to "float" with ground contours.

The rockshaft cylinder is a welded assembly and is not serviceable. A new cylinder must be installed if the old cylinder is defective. Check "Diagnosing Malfunctions," page 60-10-6, for possible causes of cylinder failure.

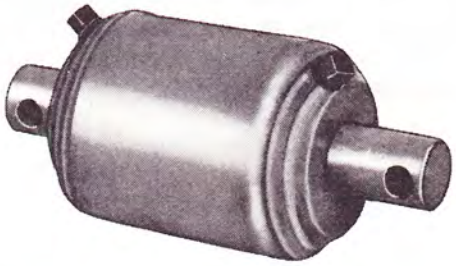

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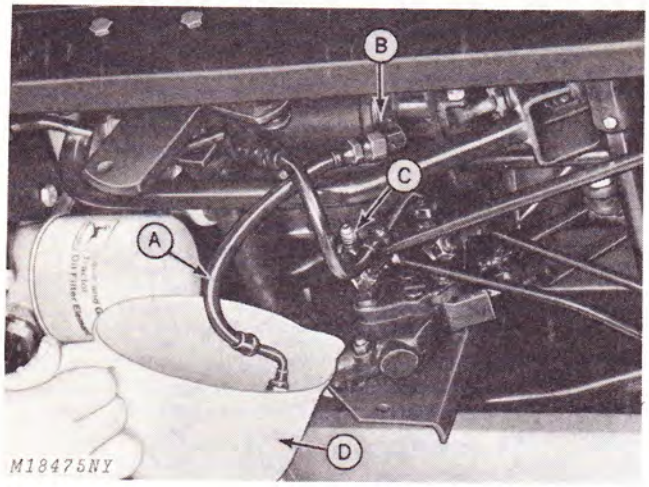
Fig. 3-Rockshaft Cylinder

TESTING



A—Hose
B—Cylinder
C—Control Valve
D—Container

Fig. 4-Testing Hydraulic Cylinder - 300 Tractor Illustrated

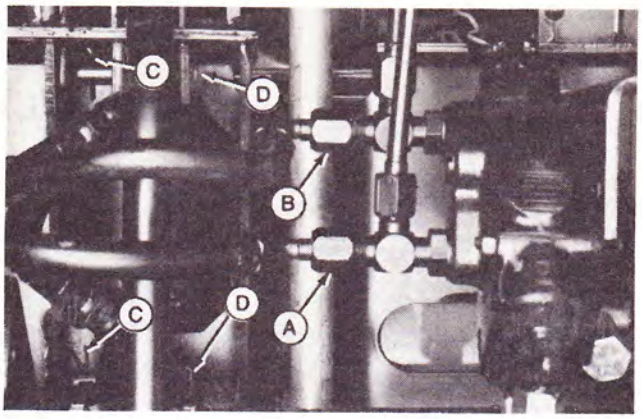
Retract cylinder.

Disconnect hose (A) at control valve (C). This hose goes to forward end of cylinder (B).

Place end of hose in a clean container (D).

Start engine. Move hydraulic control lever to retract cylinder. After initial oil flow stops there should be no oil flow into container. Continuous oil flow indicates internal leakage and cylinder must be replaced.

REMOVAL



A—Fitting
B—Fitting
C—Cotter Pins
D—Drill Pins

Fig. 5-Disconnecting Rockshaft Cylinder

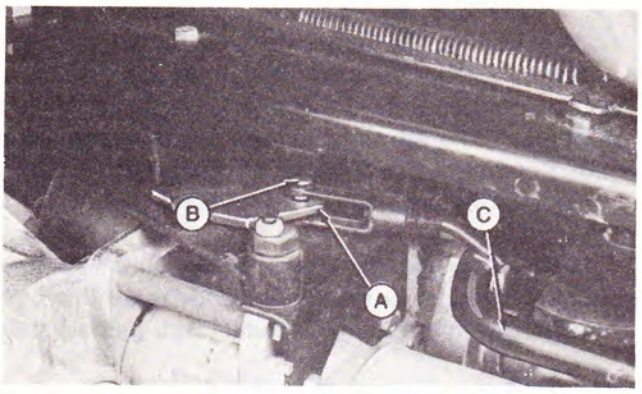
CAUTION: Hydraulic oil escaping under pressure can penetrate the skin, causing serious injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure, be sure all connections are tight and all components are in good condition. Use a piece of cardboard or wood, rather than hands, to search for leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Wipe all dirt from connections on valve body. Move hydraulic control lever back and forth to relieve all pressure in the system.

Mark hoses. Disconnect hoses at fittings (A and B, Fig. 5) at control valve ports. Cap hoses and ports to prevent entry of dirt.

Remove cotter pins (C) and drilled pins (D).

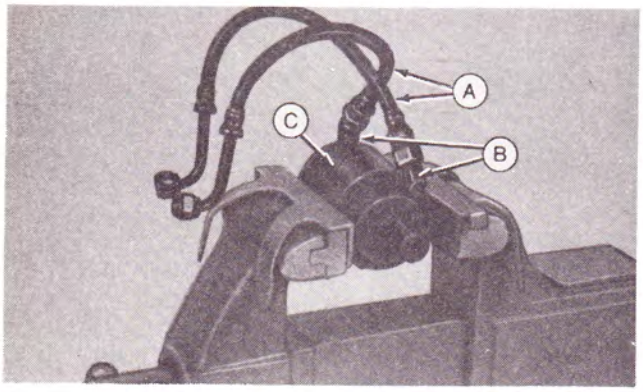


M28911

A—Cotter Pin
B—Pin
C—Hydrostatic Control Lever

Fig. 6-Disconnecting Hydrostatic Control Lever

Remove cotter pin (A) and pin (B). Drop hydrostatic control lever (C) down.



M28915

A—Hoses
B—Fittings
C—Cylinder

Fig. 7-Removing Hoses and Fittings

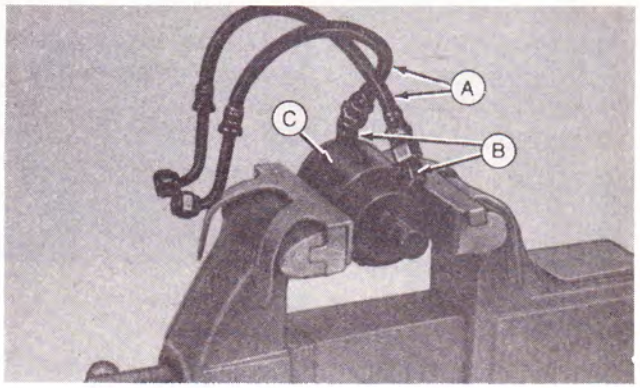
Lightly clamp cylinder in a soft jaw vise. Remove hoses (A, Fig. 7) and fittings (B) from cylinder (C).

Repair

The cylinder is service as a complete assembly only.

Replace cylinder if it is defective.

INSTALLATION



M28915

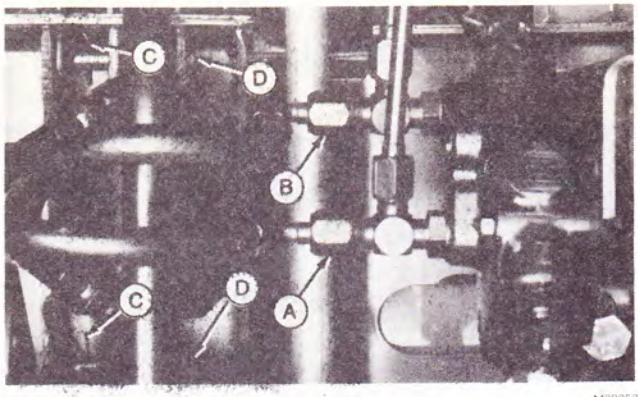
A—Hoses
B—Fittings
C—Cylinder

Fig. 8-Installing Hoses and Fittings

Lightly clamp cylinder in a soft jaw vise. Apply sealing compound to threads of fittings (B, Fig. 8).

Screw fittings (B) to cylinder (C) as shown.

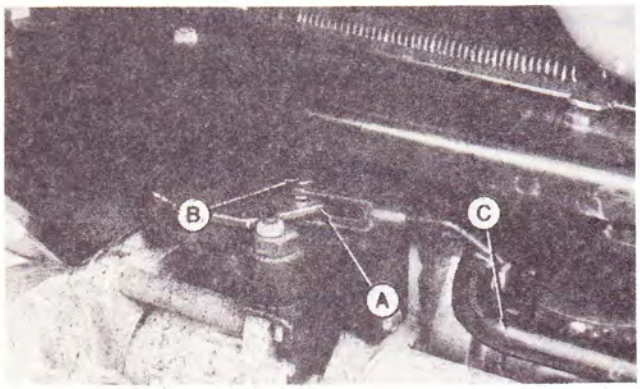
Attach hoses (A) to fittings (B).



M30353

A—Fitting
B—Fitting
X—Cotter Pins
D—Drilled Pins

Fig. 9-Installing Rockshaft Cylinder



M28911

A—Cotter Pin
B—Pin
C—Hydrostatic Control Lever

Fig. 10-Connecting Hydrostatic Control Lever

Position cylinder in support bracket, with rod end toward rear of tractor.

Install drilled pins (D, Fig. 9) and cotter pins (C).

Connect hydrostatic control lever (C, Fig. 10) with pin (B) and cotter pin (A).

Attach hose from forward end of cylinder at fitting (A. Fig. 9) at rear control valve port. Attach hose from rear of cylinder to fitting (B) at front control valve port. Route hoses below hydrostatic linkage.

⚠ CAUTION: Hydrostatic oil escaping under pressure can penetrate the skin, causing serious injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure, be sure all connections are tight and all components are in good condition. Use a piece of cardboard or wood, rather than hands, to search for leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Start engine and operate control lever to actuate cylinder. Check for leaks.

Specifications

Bore	2½ in. (63.50 mm)
Stroke	1½ in. (38.10 mm)
Rod Diameter	0.875 in. (22.225 mm)

Section 70
MISCELLANEOUS
Group 5
STEERING LINKAGE

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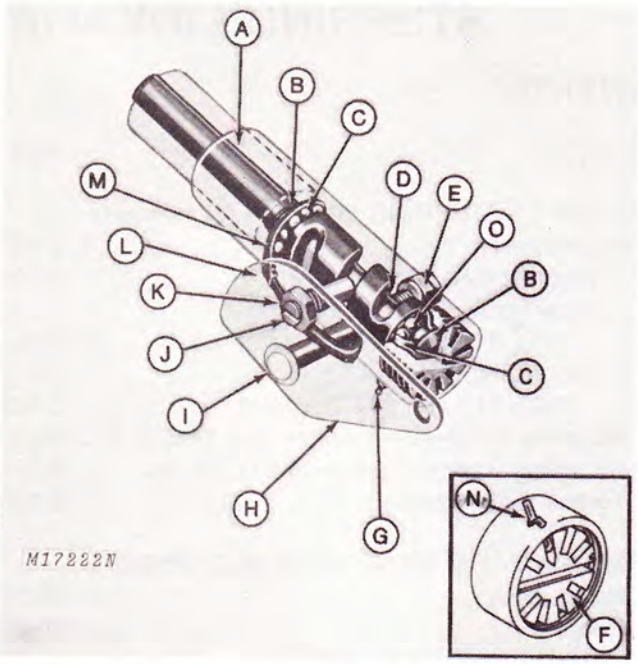
GENERAL INFORMATION

300, 312 and 316 Tractors



N17222N

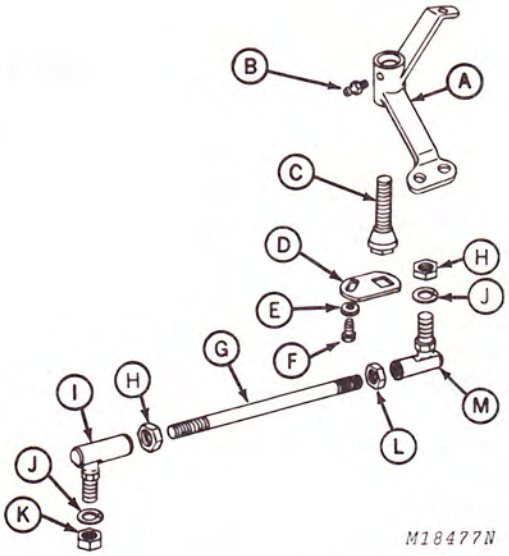
A —Housing
B —Spring Washer
C —Bearing Cup
D —Cam
E —Jam Nuts
F —Adjusting Plug
G—Grease Fitting
H —Lever Arm
I —Pivot Bolt (Part of H)
J —Tapered Stud
K —Lock Nut
L —Seal
M—Seal Retainer
N —Cotter Pin
O—Bearing Balls

Fig. 1-Ross Steering Gear

The steering linkage consists of the steering wheel, steering gear assembly, drag link, spindle and tie rods.

The steering gear has a 14:1 steering ratio. It is a cam and lever-type steering gear utilizing the cam (D), lever arm (H), pivot bolt (I) and tapered stud (J) shown in Fig. 1.

The lever arm (H) is actuated whenever the cam is rotated. This in turn, pulls or pushes the drag link connected to the left steering spindle, turning the wheels left or right.



A —Steering Arm
B —Grease Fitting
C —Bolt with Cone
D —Locking Strap
E —Washer
F —Self-tapping Screw
G—Tie Rod
H —Jam Nut
I —Ball Joint
J —Lock Washer
K —Nut
L —Jam Nut
M—Ball Joint

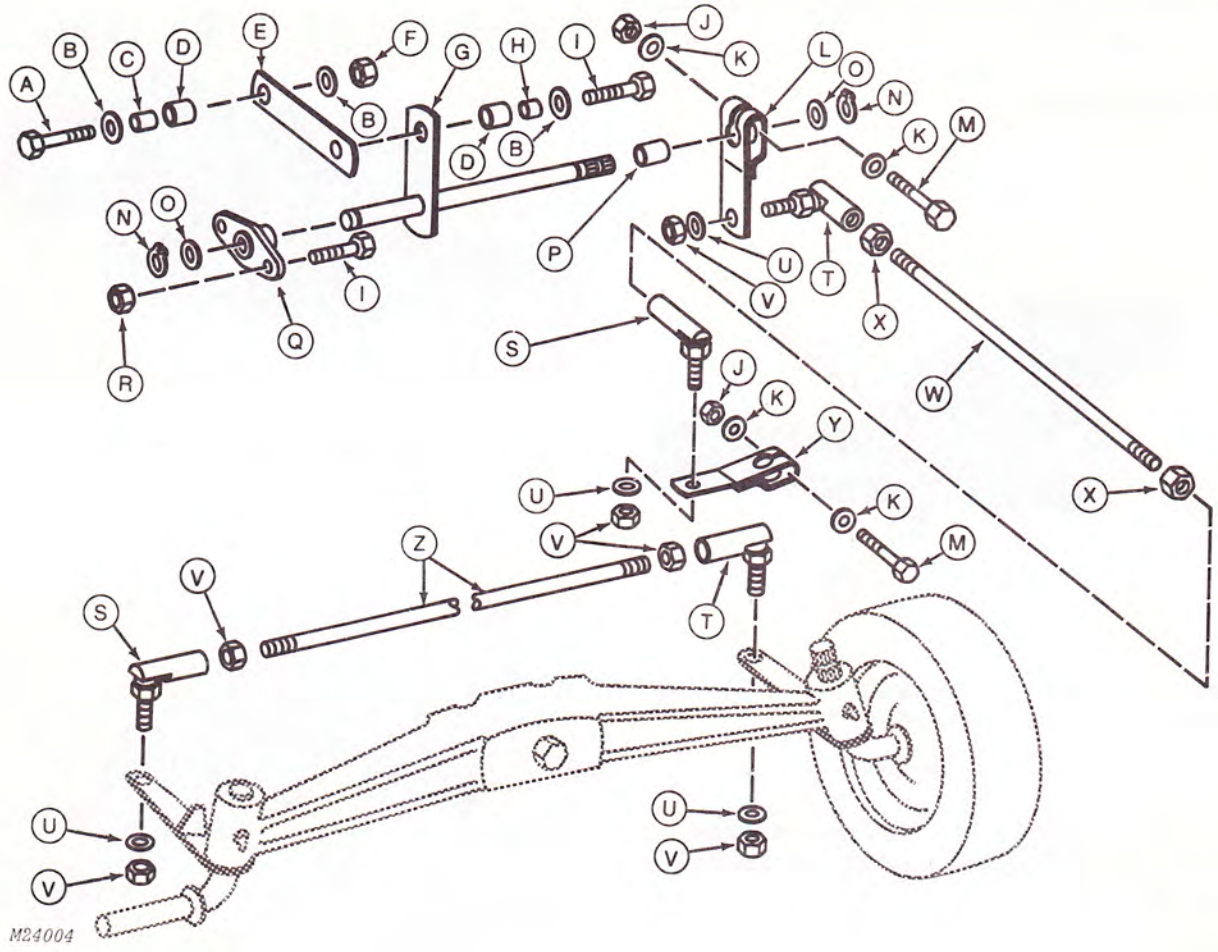
Fig. 2-Steering Arm and Tie-Rod Assembly on 300, 312 and 316 Tractors

On 300, 312 and 316 Tractors, the cam (D, Fig. 1) is actuated by the steering wheel and shaft. This in turn, pulls or pushes the drag link, causing rotation of the steering arm (A, Fig. 2) on the bolt and cone assembly (C).

Movement of the steering arm causes the tie rods (G, Fig. 2) to move the spindles in the front axle, thereby changing wheel position.

GENERAL INFORMATION—Continued

314 Tractor



M24004

A —Cap Screw, 3/8" x 1¼"
B —Flat Washer, 13/32" x 1¼" x 0.120"
C —Bushing
D —Bearing
E —Link
F —Hex. Nut, Special, 3/8"
G —Pivot Shaft
H —Bushing
I —Cap Screw, 3/8" x ¾"
J —Lock Nut, 3/8"
K —Flat Washer, 13/32" x ¾" x 0.105"
L —Steering Arm, Rear
M—Cap Screw, 3/8" x 2"
N —Snap Ring
O —Flat Washer, 25/32" x 1¼" x 0.105"
P —Bushing
Q —Bearing
R —Hex. Nut, 3/8"
S —Ball Joint, Left-Hand Threads
T —Ball Joint, Right-Hand Threads
U —Lock Washer, ½"
V —Jam Nut, ½" (Right-Hand Threads)
W—Drag Link
X —Jam Nut, ½" (Left-Hand Threads)
Y —Steering Arm, Front
Z —Tie Rod

Fig. 3-Exploded View of Steering Linkage Assembly on 314 Tractor

On 314 Tractors, the steering wheel and steering gear actuate the pivot shaft (G), Fig. 2. The rear steering arm (L) is connected to the pivot shaft and drag link (W). This in turn, pulls or pushes the front steering arm (Y) which is connected to the left-hand front wheel spindle.

Movement of the front steering arm turns the left-hand spindle. The tie rod (Z) turns the right-hand wheel.

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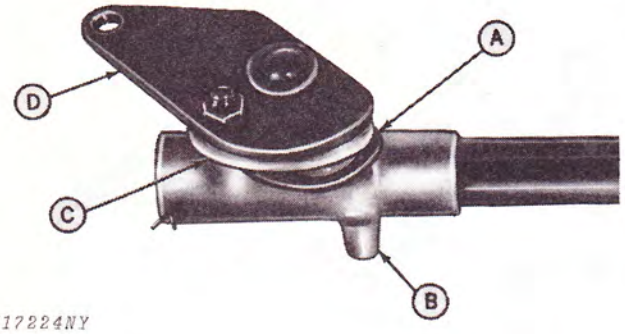
STEERING ANALYSIS

Listed below are some difficulties that might occur with the steering system. Familiarize yourself with this information before proceeding to "Diagnosing Malfunctions" on page 70-5-6.

Seal and Retainer



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A—Seal
B—Housing
C—Seal Retainer
D—Lever Arm

Fig. 4-Damaged Seal

A damaged seal (A, Fig. 4) is caused by overgreasing the housing (B), or improperly adjusting the cross bolt in the lever arm (D).

Housing

A broken steering gear housing, Fig. 5, is most commonly caused by the wheels striking a solid object when the tractor is traveling at fast speed. It can also be caused by applying excessive pressure on the steering wheel with a heavy load on the front of the tractor.

To reduce steering effort, the tractor should be in motion when turning the front wheels, especially with heavy ballast on the front of the tractor.

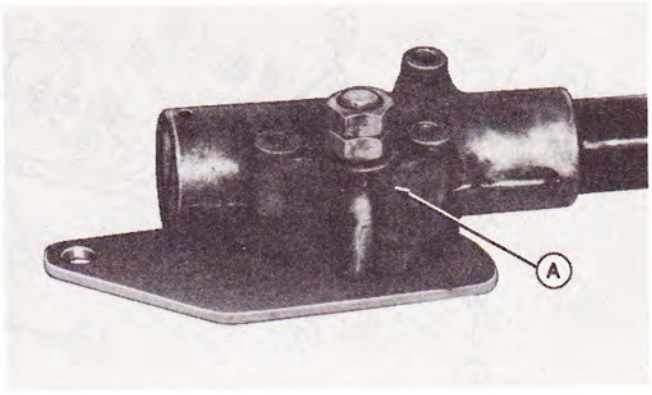

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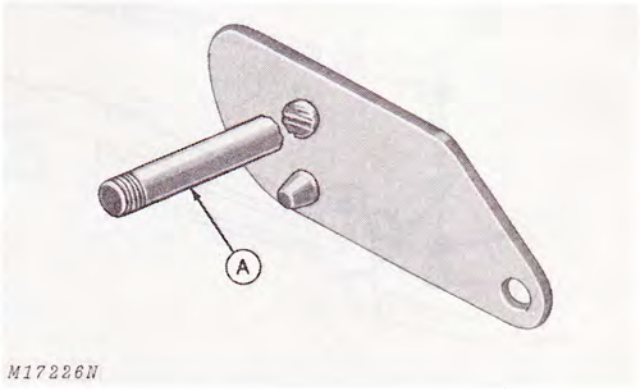
Fig. 5-Broken Steering Gear Housing



M17226N

M17226N

Fig. 6-Broken Lever Arm Cross Bolt

A broken lever arm cross bolt, Fig. 6, is caused by excessive force being applied by the steering wheel or severe shock load from tires.

STEERING ANALYSIS—Continued

Ball Joints

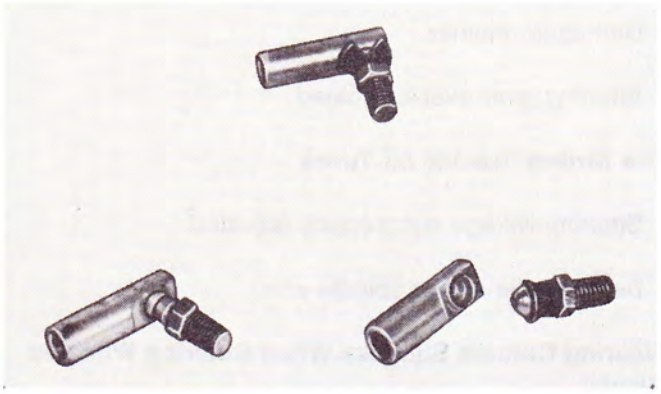


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Fig. 7-Damaged Ball Joints

Replace ball joint assembly whenever excessive looseness or other damage is noticed, Fig. 7.

DIAGNOSING MALFUNCTIONS

Loose Steering

Steering gear out of adjustment.

Cracked steering gear housing.

Loose ball joint nuts.

Worn ball joints.

Axle not snug between pivot plages on 314 Tractor.

Hard Steering

Grease fittings not lubricated.

Tires not properly inflated.

Steering gear not properly adjusted (too tight).

Axle too tight between pivot plates on 314 Tractor.

Tight spindles.

Steering arms not positioned properly on 314 Tractor.

Drag link installed incorrectly.

Bent spindle arm.

Tight ball joints.

Incorrect toe-in.

Tractor Turns Shorter in One Direction

Tie rods adjusted improperly.

Steering arms not positioned properly on 314 Tractor.

Drag link installed and/or adjusted incorrectly.

Bent spindle and/or spindle arm.

Leaky Steering Gear Housing

Damaged seal.

Damaged retainer.

Steering gear over-lubricated.

Tire Strikes Tractor on Turns

Steering linkage not properly adjusted.

Bent spindle and/or spindle arm.

Steering Column Squeaks When Steering Wheel is Turned

Lack of lubrication.

Excessive end play.

Loose adjusting plug.

Tire Wear

Wheels toed-out or toed-in excessively.

Bent spindle and/or spindle arm.

Tires not properly inflated.

Litho in U.S.A.

DIAGNOSING MALFUNCTIONS

Loose Steering

Steering gear out of adjustment.

Cracked steering gear housing.

Loose ball joint nuts.

Worn ball joints.

Axle not snug between pivot plages on 314 Tractor.

Hard Steering

Grease fittings not lubricated.

Tires not properly inflated.

Steering gear not properly adjusted (too tight).

Axle too tight between pivot plates on 314 Tractor.

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Steering arms not positioned properly on 314 Tractor.

Drag link installed incorrectly.

Bent spindle arm.

Tight ball joints.

Incorrect toe-in.

Tractor Turns Shorter in One Direction

Tie rods adjusted improperly.

Steering arms not positioned properly on 314 Tractor.

Drag link installed and/or adjusted incorrectly.

Bent spindle and/or spindle arm.

Leaky Steering Gear Housing

Damaged seal.

Damaged retainer.

Steering gear over-lubricated.

Tire Strikes Tractor on Turns

Steering linkage not properly adjusted.

Bent spindle and/or spindle arm.

Steering Column Squeaks When Steering Wheel is Turned

Lack of lubrication.

Excessive end play.

Loose adjusting plug.

Tire Wear

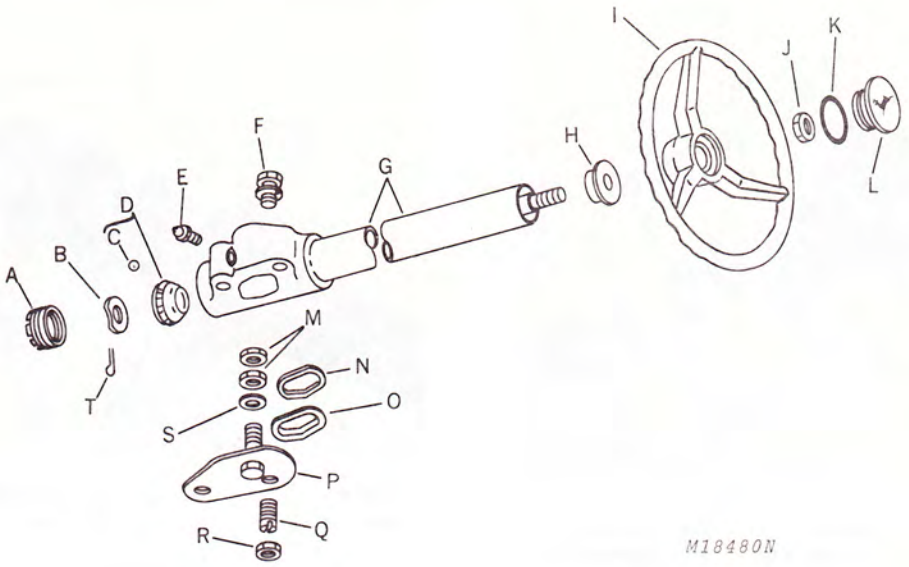
Wheels toed-out or toed-in excessively.

Bent spindle and/or spindle arm.

Tires not properly inflated.

Litho in U.S.A.

REPAIR



A —Adjusting Plug
B —Spring Washer
C —Ball
D —Bearing Kit
E —Grease Fitting
F —Cap Screw
G —Steering Gear Assembly
H —Bearing
I —Steering Wheel
J —Jam Nut
K —O-Ring
L —Cap
M—Jam Nut
N —Seal
O —Seal and Retainer Kit
P —Lever Arm
Q —Stud
R —Jam Nut
S —Washer
T —Cotter Pin

Fig. 8-Exploded View - Steering Linkage

Removing Steering Wheel and Steering Gear

Remove steering wheel with a puller (A, Fig. 9).

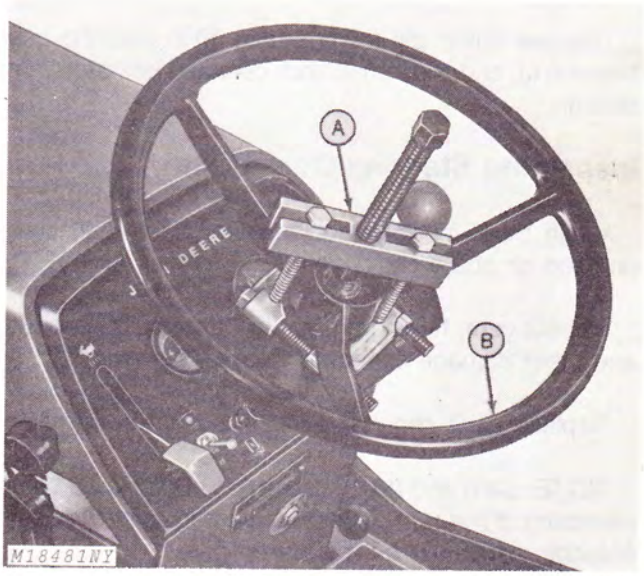
IMPORTANT: The wrong puller will damage the steering wheel. See page 80-10-2 for correct puller.

Remove battery and battery box.

Disconnect drag link from lever arm.

Remove cap screws holding housing to frame and slip steering gear down to clear dash.

Disconnect wiring harnesses from light switch, key switch and PTO switch. Then, lift steering gear assembly out.



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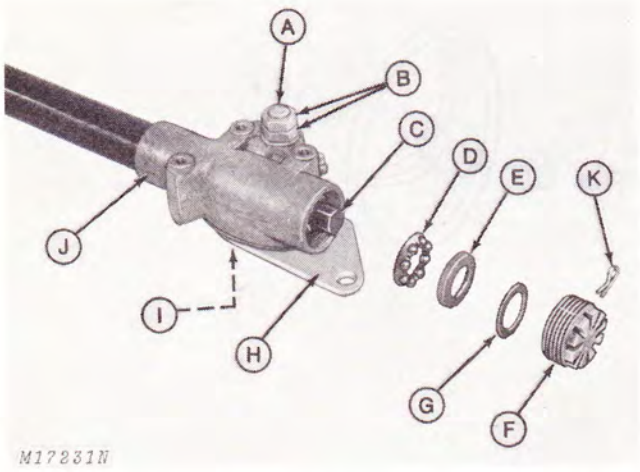
A—Puller **B—Steering Wheel**

Fig. 9-Removing Steering Wheel

Disassembling Steering Gear



A—Cross Bolt **D—Bearing** **H—Lever Arm**
G—Lock Nuts **E—Bearing Cup** **I—Tapered Stud**
C—Steering Shaft **F—Adjusting Plug** **J—Housing**
G—Spring Washer **K—Cotter Pin**

Fig. 10-Disassembling Steering Gear

Loosen jam nut on tapered stud (I) in lever arm (H), Fig. 10.

Turn stud (I) in until resistance is felt.

Remove nuts (B) from lever arm cross bolt (A), and remove cross bolt from housing.

Remove cotter pin (K) and plug (F) in steering gear housing (J) and slide shaft with cam and bearings from column.

Inspecting Steering Gear Parts

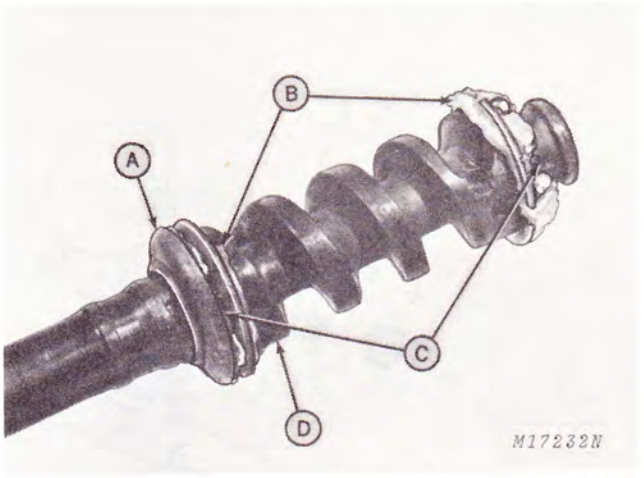
Wash parts in clean solvent. Dry them with compressed air and a clean cloth.

Inspect cam, housing, and plug for cracks, scoring, and other damage especially in the bearing area.

Replace parts showing excessive wear or damage.

NOTE: Cam and housing are not available as separate parts. If the cam or housing are damaged the entire steering gear must be replaced.

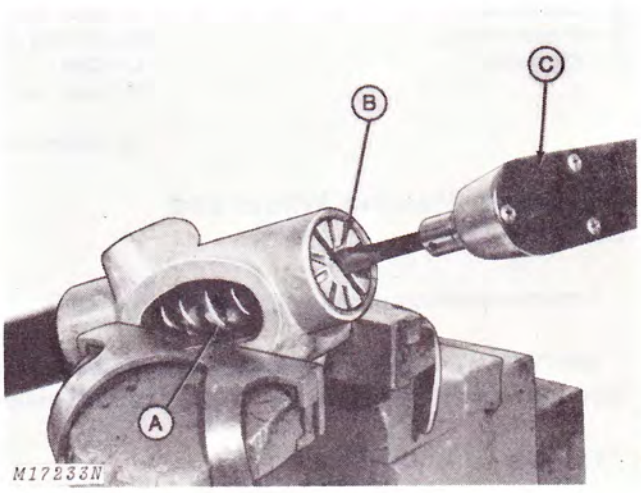
Assembling Steering Gear



A—Cups **C—Bearing Balls**
B—Grease **D—Cam**

Fig. 11-Installing Bearings

Apply grease (John Deere Multi-Purpose Lubricant or equivalent) and place bearing balls (C, Fig. 11), ball cups and cups (A) on both ends of cam (D).

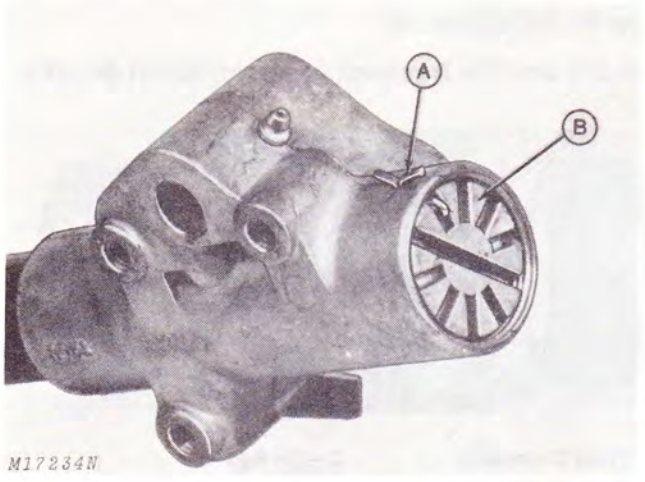


A—Cam **B—Plug** **C—Torque Wrench**

Fig. 12-Installing Cam Assembly in Housing

Grease cam (A, Fig. 12) lightly with John Deere Multi-Purpose Lubricant or an equivalent SAE multi-purpose-type grease.

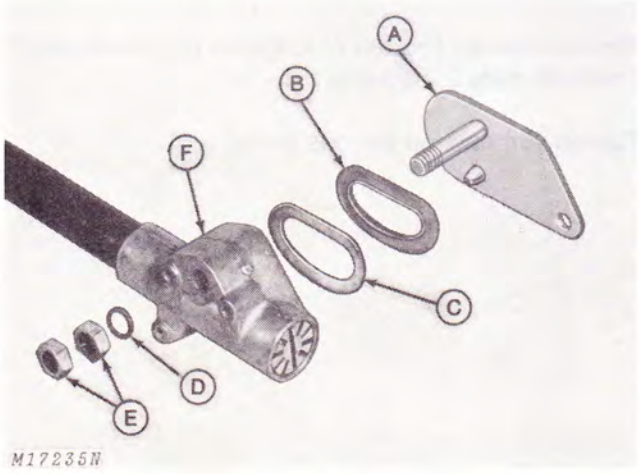
Slide cam and shaft assembly into housing. Install plug (B) and tighten to 10 to 14 ft-lbs (13.6 to 17.6 Nm) torque.



A—Cotter Pin **B—Adjusting Plug**

Fig. 13-Installing Cotter Pin Through Housing

After tightening adjusting plug (B, Fig. 13) to 10 to 14 ft-lbs (13.6 to 17.6 Nm) torque, lock adjusting plug (B) with a cotter pin (A). Be sure steering shaft turns freely after tightening adjusting plug.



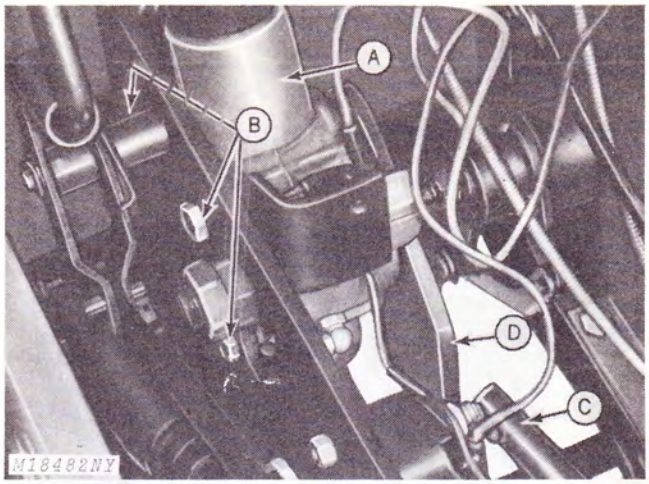
A—Lever Arm
B—Retainer
C—Seal
D—Washer
E—Jam Nuts
F—Housing

Fig. 14-Attaching Lever Arm to Steering Gear

Install new seal (C, Fig. 14) and retainer (B) from repair kits. Attach lever arm (A) to steering gear housing (F) with washer (D) and jam nuts (E).

Adjust the steering gear according to the sequence on page 10-20-18.

Installing Steering Gear



A—Steering Gear Assembly
B—Cap Screws
C—Drag Link
D—Lever Arm

Fig. 15-Installing Steering Gear (300 Tractor Illustrated)

Position steering gear assembly (A, Fig. 15) in tractor. Install steering gear with cap screws (B) as shown. Apply Loctite or equivalent to threads of cap screws.

On 300, 312 and 316 Tractors, connect drag link (C) to lever arm (D) and tighten nut firmly. On 314 Tractor, connect steering shaft link (E, Fig. 3), page 70-5-3, to lever arm (D, Fig. 15).

Reinstall wiring harnesses.

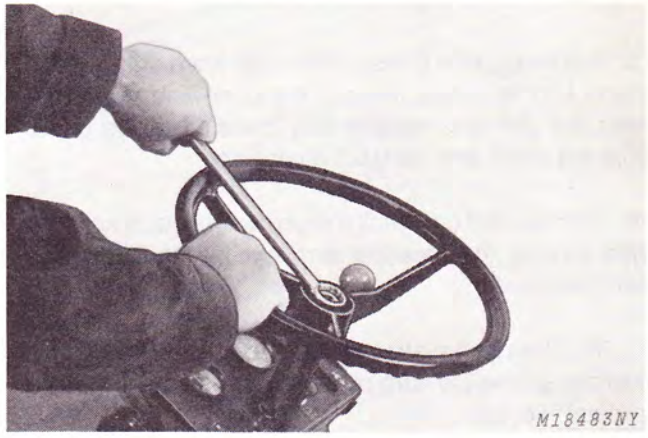


Fig. 16-Installing Steering Wheel

Install steering wheel, Fig. 16. Tighten steering wheel retaining nut to 10 to 12 ft-lbs (13.6 to 16.3 Nm) torque.

Insert O-ring into slot in steering wheel cap and press cap into steering wheel.

ADJUSTMENTS

Steering Gear Adjustment

See page 10-20-18.

Steering Cone Adjustment

300, 312 and 316 Tractors (Serial No. 30,001-95,000)

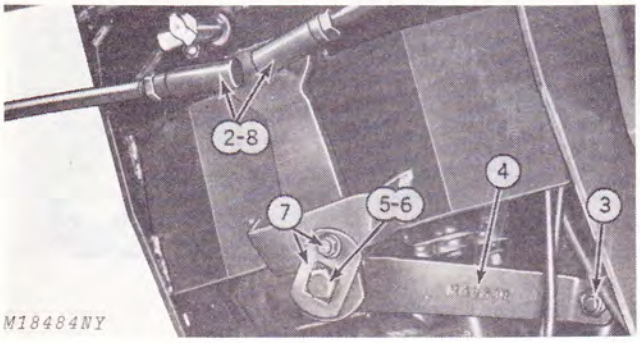


Fig. 17-Adjusting Steering Cone on 300, 312 and 316 Tractors (Serial No. 30,001-95,000)

1. Block front of tractor so the front tires are off the ground.

2. Disconnect ball joints, Fig. 17.

3. Disconnect drag link.

4. Turn steering arm by hand. A properly adjusted steering arm will pivot freely through the entire steering range with only a slight amount of drag.

5. If steering arm turns hard or has worn or loosened so end play is noted, remove the cone and pivot bolt. Clean out dirt and remove any burrs from the cone. Lubricate cone and reinstall pivot bolt.

6. Tighten bolt only until a slight amount of drag is felt when turning the steering arm and all end play has been removed.

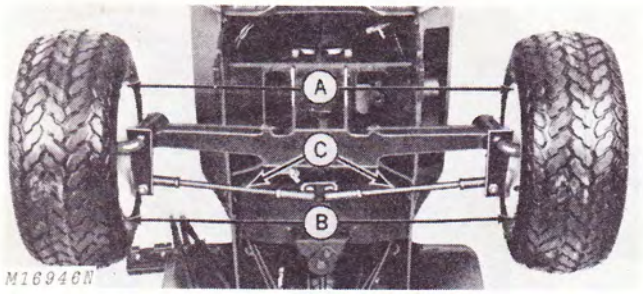
7. Position lock plate over bolt head and tighten lock plate cap screw. Be sure plain washer is used with lock plate cap screw.

NOTE: If lock plate cannot be installed without turning bolt out of adjusted position, turn plate over.

8. Connect ball joints, Fig. 17.

Toe-In Adjustment

300, 312 and 316 Tractors (Serial No. 30,001-95,000)



A—Front Dimension **C—Tie Rod**
B—Rear Dimension

Fig. 18-Adjusting Front-Wheel Toe-In on 300, 312 and 316 Tractors (Serial No. 30,001-95,000)

Position front wheels straight ahead, Fig. 18.

Measure front dimension (A) and rear dimension (B).

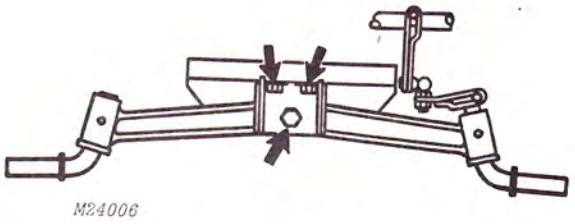
When properly adjusted, front dimension (A) should be 3/16 inch shorter than rear dimension (B).

To adjust toe-in, shorten or lengthen right-hand and left-hand tie rods (C) equally.

Tighten jam nuts on tie rods firmly.

ADJUSTMENTS—Continued

Adjusting Front Axle Pivot on 314 Tractor



M24006

Fig. 19-Adjusting Pivot Bolt

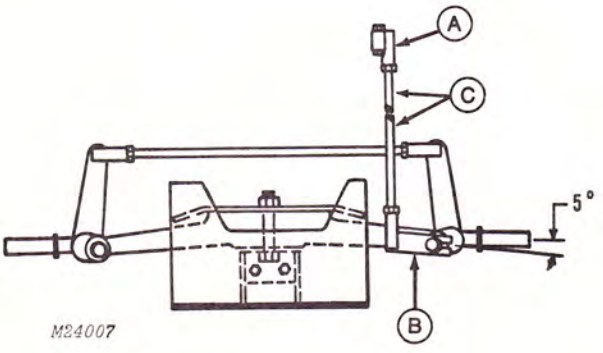
1. Raise front of tractor so tires are off surface.

2. Check axle movement. Axle must be snug but free to pivot and have no lateral movement.

3. If axle can be moved laterally, loosen two pivot plate mounting bolts, Fig. 19, remove cotter pin and tighten axle pivot bolt until axle is snug between pivot plate and base. Reinstall cotter pin and tighten pivot plate mounting bolts after adjustment.

Adjusting Turning Radius on 314 Tractor

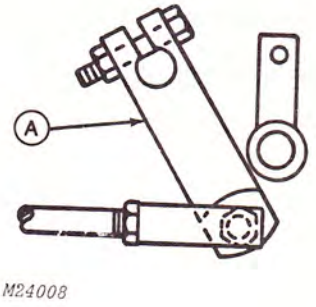
NOTE: Be sure steering gear and toe-in is adjusted properly as shown on page 10-20-18 and 10-20-19 before adjusting turning radius.



M24007

A—Rear Steering Arm **C—Drag Link**
B—Front Steering Arm

Fig. 20-Drag Link and Front Steering Arm



M24008

Fig. 21-Rear Steering Arm and Drag Link

The position of steering arms (A) and (B), Fig. 20 and 21, and length of drag link (C) determine turning radius.

Position front wheels straight ahead and disconnect drag link from rear steering arm (A, Fig. 21), to check position of steering arms.

To check position of rear steering arm, Fig. 21, turn steering wheel clockwise as far as possible. Check position of steering arm. The steering arm should be as close as possible to brake shaft as shown in Fig. 21. If not, remove it from splined shaft and position it as close as possible to brake shaft. Secure in place after adjustment.

To check position of front steering arm (B, Fig. 20), manually position front wheels straight ahead. The steering arm should be 5° or more rearward off center of spindle axle as shown. If not, remove it and position as necessary.

After checking or repositioning steering arms, adjust turning radius as follows:

1. Turn steering wheel through its full range, counting number of turns.
2. Turn steering wheel half-way back to midpoint of range.
3. Loosen jam nuts on drag link (C, Fig. 20).
4. Lengthen or shorten drag link until it can be easily reconnected to rear steering arm (A, Fig. 20), without disturbing the straight forward position of wheels.
5. Connect drag link to steering arm and tighten jam nuts after adjustment.

NOTE: For fine turning radius adjustments, the drag link can be adjusted without disconnecting it from the steering arm. Loosen jam nuts on drag link and turn link for fine adjustments.

TORQUE FOR HARDWARE

Location	Torque
Steering gear plug	10 to 14 ft-lbs (13.6 to 17.6 Nm)
Lever arm cross bolt	22 to 25 ft-lbs (29.8 to 33.9 Nm)
Jam nut on lever arm stud	40 ft-lbs (54.2 Nm)
Steering wheel retaining nut	10 to 12 ft-lbs (13.6 to 16.3 Nm)

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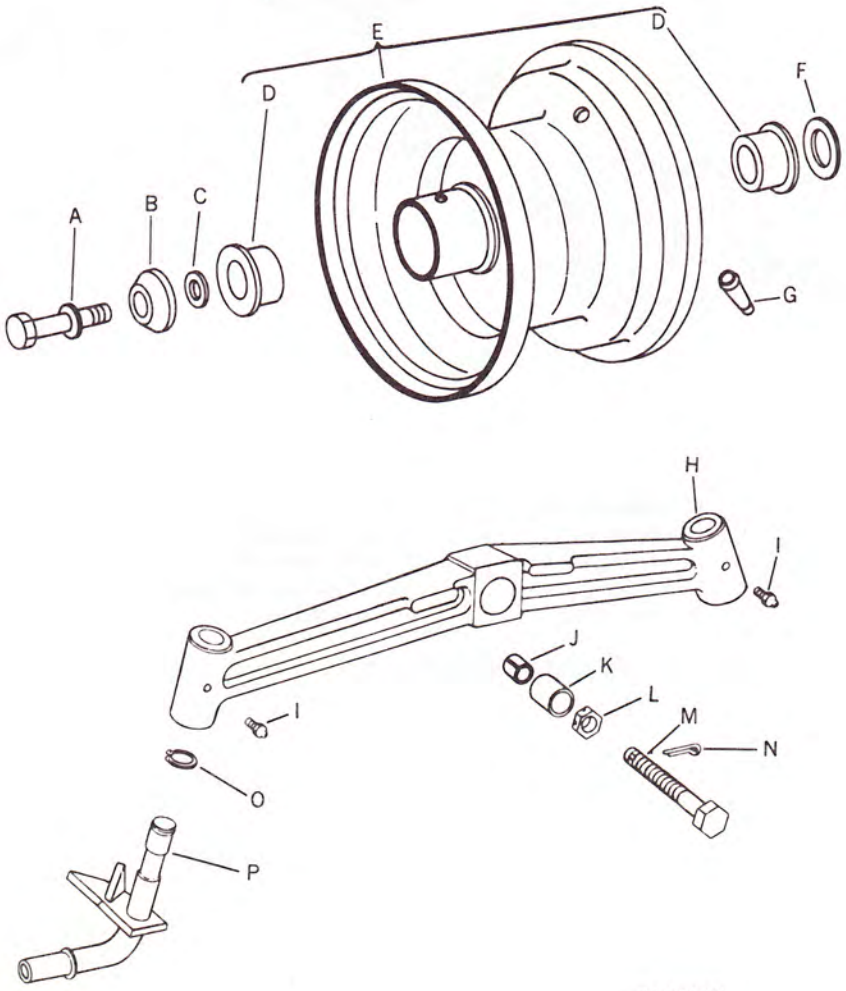
Group 10
FRONT WHEELS AND AXLES

INTRODUCTION

Refer to Group 5, "Steering Linkage" for service and adjustment of all linkage related to the front wheels. Group 5 includes service of ball joints, drag links, tie rods, toe-in adjustment, etc. This group covers only front wheel spindles and axle.

REPAIR

300, 312 and 316 Tractors



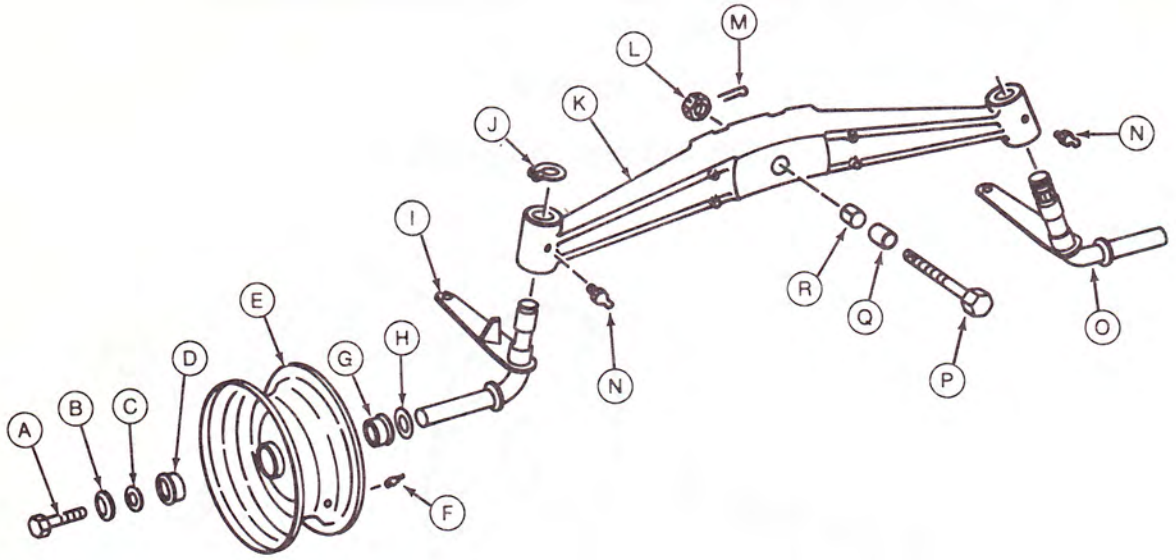
A—Cap Screw
B—Spindle Cap
C—Washer
D—Bearings
E—Wheel
F—Spring Washer
G—Valve Stem
H—Front Axle
I —Grease Fitting
J —Spacer
K—King Pin Bushing
L —Slotted Nut
M—King Pin Bolt
N—Cotter Pin
O—Snap Ring
P—Spindle Right-Hand

Fig. 1-Exploded View of Front Wheels and Axle on 300, 312 and 316 Tractors

Litho in U.S.A.

REPAIR—Continued

314 Tractor



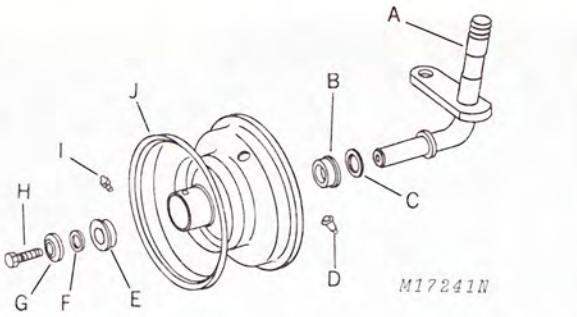
M30386

A—Cap Screw
B—Spindle Cap
C—Washer
D—Bearing
E—Wheel
F—Valve Stem
G—Bearing
H—Spring Washer
I—Spindle
J—Snap Ring
K—Front Axle
L—Slotted Nut
M—Cotter Pin
N—Grease Fitting
O—Spindle
P—Pivot
Q—Bushing
R—Spacer

Fig. 2-Exploded View of Front Axle and Wheels on 314 Tractor

Litho in U.S.A.

Removing Front Wheels



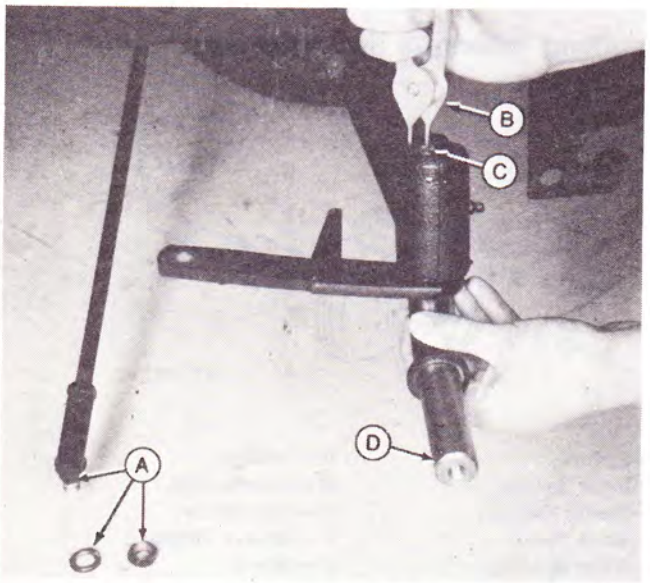
M17241N

A—Spindle
B—Inner Bearing
C—Spring Washer
D—Valve Stem
E—Outer Bearing
F—Washer
G—Spindle Cap
H—Cap Screw
I—Grease Fitting
J—Wheel

Fig. 3-Removing Front Wheel Components from Spindle

Raise tractor until wheel clears the ground. Remove cap screw (H, Fig. 2). Remove spindle cap (G), outer bearing (E), wheel (J), inner bearing (B) and spring washer (C).

Removing Spindle from Axle



M30245

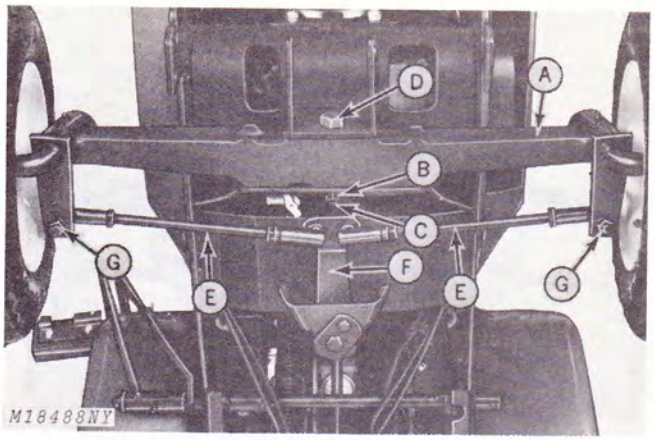
A—Tie Rod End
B—Snap Ring Pliers
C—Snap Ring
D—Spindle

Fig. 4-Removing Spindle

To remove spindle (D, Fig. 4), disconnect tie rod end (A), and using a snap ring pliers (B), remove snap ring (C) from spindle (D). Slip spindle (D) out of axle.

Removing Front Axle

300, 312 and 316 Tractor



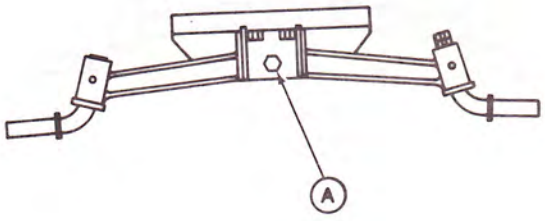
M18488NY

A—Front Axle
B—Cotter Pin
C—Slotted Nut
D—King Pin Bolt
E—Tie Rods
F—Steering Arm
G—Spindle Arm

Fig. 5-Removing Front Axle on 300, 312 and 316 Tractors

To remove front axle (A), block up or hoist front of tractor. Remove wheels, Fig. 3. Remove spindles, Fig. 4. Remove cotter pin (B) from slotted nut (C, Fig. 5). Remove nut and king pin bolt (D). Ease axle to floor.

314 Tractor



M30385

A—Pivot Bolt

Fig. 6-Removing Axle on 314 Tractor

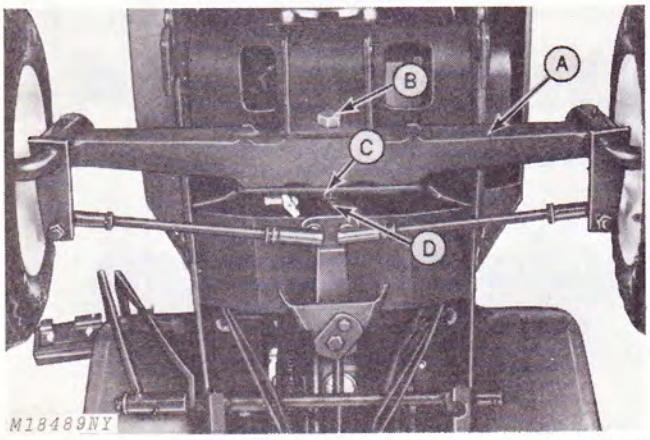
Block up or hoist front of tractor.

1. Remove wheels, Fig. 3.
2. Remove spindles, Fig. 4.
3. Remove pivot bolt (A, Fig. 6) and ease axle to floor.

INSTALLATION

Installing Axle

300, 312 and 316 Tractors



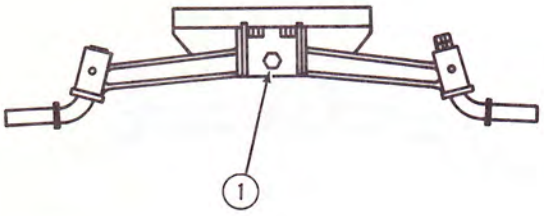
M18489NY

A—Axle
B—King Pin Bolt
C—Slotted Nut
D—Cotter Pin

Fig. 7-Installing Axle on 300, 312 and 316 Tractor

Grease king pin assembly and install axle (A), Fig. 7. Tighten king pin bolt (B) until it takes 25 to 75 lbs (11.34 to 34.02 kg) force at the end of the axle to rotate it up or down. Secure slotted nut (C) with cotter pin (D).

314 Tractor



M24010

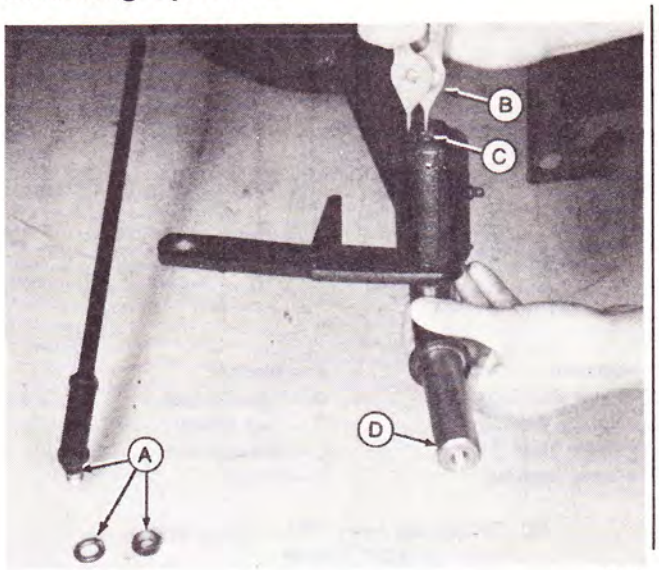
Fig. 8-Installing Axle on 314 Tractor

1. Grease pivot bolt and install axle Fig. 8. Tighten slotted nut until axle is snug between pivot plate and base. Axle must be free to pivot but have no lateral movement. Install cotter pin and spread ends.

NOTE: If axle moves laterally after pivot bolt is installed, refer to page 70-5-11, Fig. 19, and adjust front axle pivot plates.

2. Install spindles, Fig. 9.
3. Install wheels, Fig. 10.

Installing Spindles



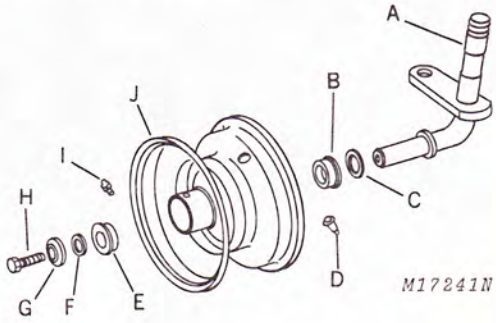
M30245

A—Tie Rod End
B—Snap Ring Pliers
C—Snap Ring
D—Spindle

Fig. 9-Installing Front Axle Spindles and Front Wheels

Apply a light coat of grease on upper spindle shaft. Install spindle (D, Fig. 9) into axle and secure with snap ring (C). Connect tie rod end (A).

Installing Bearings and Wheels



M17241

A —Spindle
B —Inner Bearing
C —Spring Washer
D —Valve Stem
E —Outer Bearing
F —Washer
G—Spindle Cap
H—Cap Screw
I —Grease Fitting
J —Wheel

Fig. 10-Installing Bearings and Wheels

Pack wheel bearings with John Deere Multipurpose Lubricant or equivalent SAE Multipurpose-type grease.

Install spring washer (C), inner bearing (B), wheel (J), outer bearing (E), washer (F), spindle cap (G) and cap screw (H), Fig. 10.

NOTE: There is no adjustment necessary on the front wheel bearings.

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Section 80
SPECIAL SERVICE TOOLS
Group 5
ENGINE CONVENIENCE SERVICE TOOLS

TABLE OF CONTENTS

	Page
Group 5 - Engine Convenience Service Tools	5-2
Group 10 - Tractor Convenience Service Tools	10-1

NOTE: No engine or tractor service tools are considered essential to service 300, 312, 314 and 316 Tractor. Convenience service tools are listed in Groups 5 and 10 and will make the job quicker and easier.

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ENGINE CONVENIENCE SERVICE TOOLS

The convenience service tools listed in this group are strictly for the convenience of the mechanic. They are not required, but they will make the job quicker and easier.

They can be ordered from:

Service Tools
Division of Owatonna Tool Company
P.O. Box 314
Owatonna, Minnesota 55060

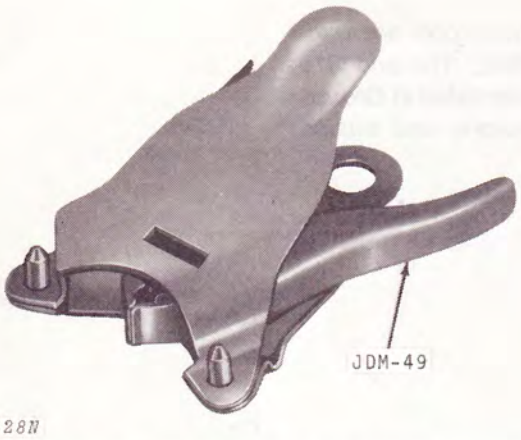

Fig. 1-JDM-49 Piston Ring Expander

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-49 Piston Ring Expander, Fig. 1, removes or installs rings on pistons up to 4 inches (1.01 cm) in diameter.

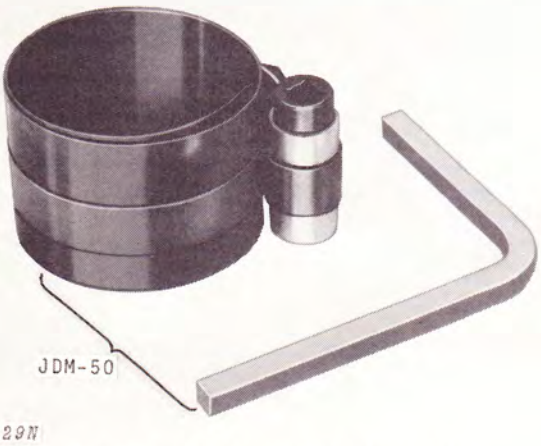

Fig. 2-JDM-50 Piston Ring Compressor

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-50 Piston Ring Compressor, Fig. 2, compresses rings on pistons from 1-3/4 inches to 3-1/2 inches (44.45 to 88.90 mm) in diameter for installation in aluminum or cast iron cylinders.

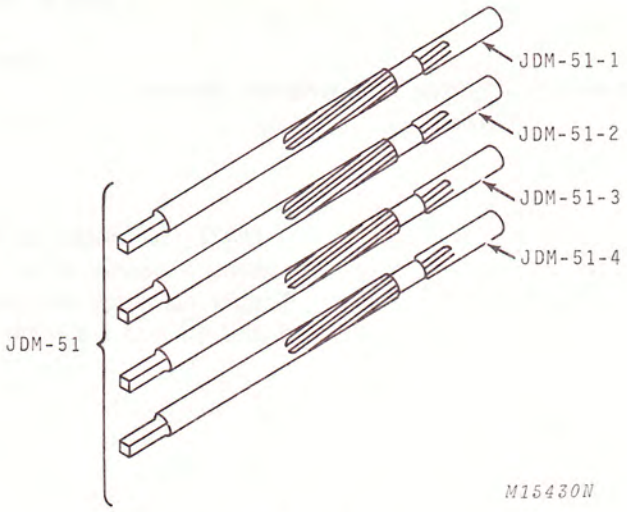

Fig. 3-JDM-51 Valve Guide Reamers

For Tecumseh and Kohler Engines

JDM-51 Valve Guide Reamer Set includes all necessary size reamers to clean carbon from standard size valve guides or to enlarge standard size guides to accept oversize valve stems. The reamers can be purchased separately as shown below.

No.	Size	Tecumseh	Kohler
JDM-51-1	0.250 in. (6.35 mm) dia.	x	
JDM-51-2	0.281 in. (7.13 mm) dia.	x	
JDM-51-3	0.312 in. (7.92 mm) dia.	x	x
JDM-51-4	0.343 in. (8.71 mm) dia.	x	

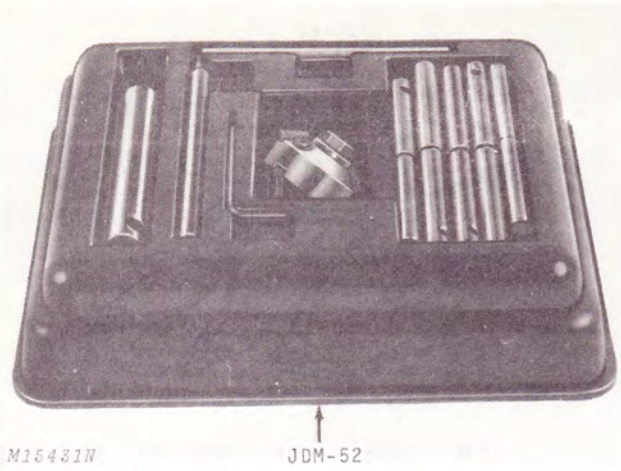

Fig. 4-JDM-52 Valve Seat Service Set

For Briggs & Sratton, Tecumseh and Kohler Engines

JDM-52 Valve Seat Service Set, Fig. 4, is a complete hand-operated, precision valve seat reconditioning kit.

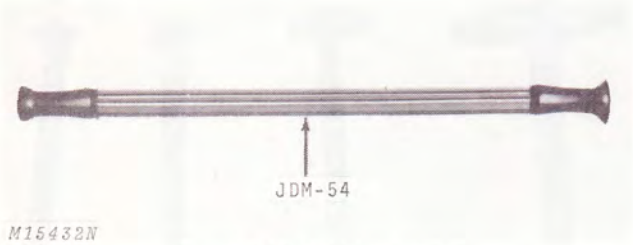

Fig. 5-JDM-54 Valve Lapper

For Briggs & Stratton and Tecumseh Engines

JDM-54 Valve Lapper, Fig. 5, permits hand-lapping small flat head or unslotted valves. Valve lapper has 5/8 inch (15.87 mm) and 13/16 inch (20.62 mm) cups.

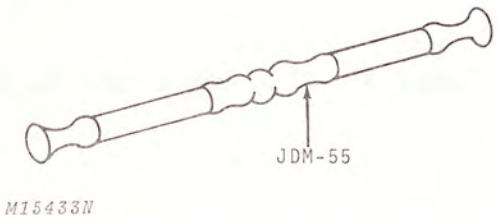

Fig. 6-JDM-55 Valve Lapper

For Kohler Engines

JDM-55 Valve Lapper, Fig. 6, permits hand-lapping flat head unslotted valves. Valve lapper has 15/16 inch (23.82 mm) and 1-1/16 inch (26.97 mm) cups.

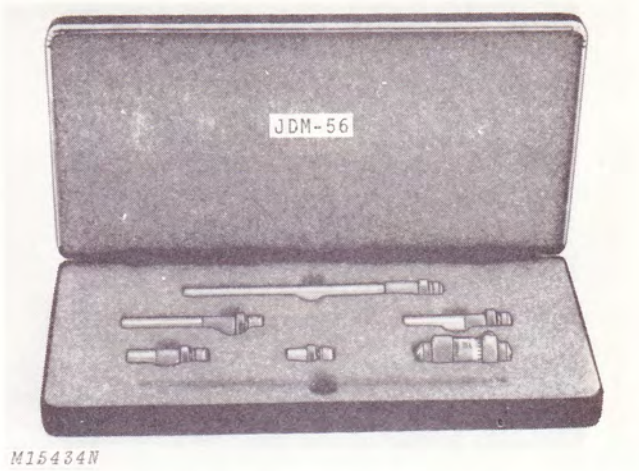

Fig. 7-JDM-56 Inside Micrometer Set

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-56 Inside Micrometer Set, Fig. 7, has six micrometers for checking inside diameters ranging from 1-1/2 inches to 8 inches.

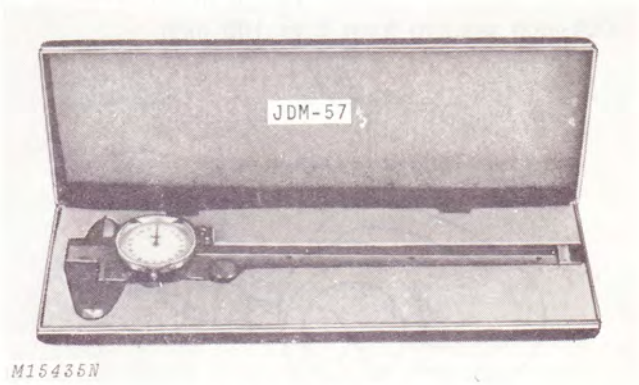

Fig. 8-JDM-57 Dial Caliper

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-57 Dial Caliper, Fig. 8, measures outside or inside dimensions from 0 to 6 inches in increments of 0.001 inch.

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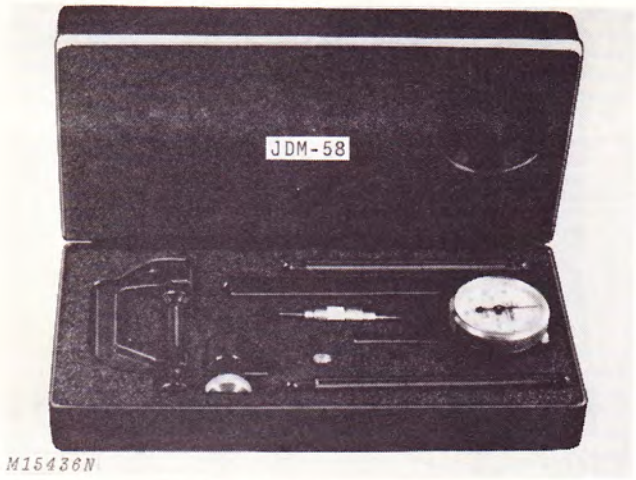

Fig. 9-JDM-58 Dial Indicator Set

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-58 Dial Indicator Set, Fig. 9, measures end play or out-of-round conditions. Set includes holder, clamp, hole attachment, connector, rods, contacts, and dial with 0.200-inch range in increments of 0.001-inch reading from 0 to 100 inch.

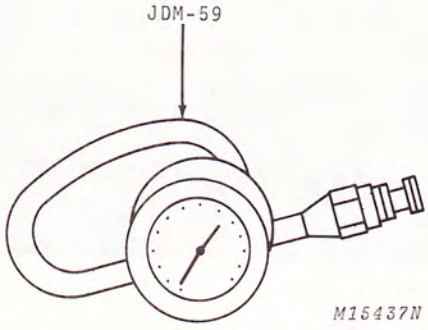

Fig. 10-JDM-59 Compression Gauge

For Tecumseh and Kohler Engines

JDM-59 Compression Gauge, Fig. 10, is capable of measuring up to 300 lbs. pressure. Use in 14 mm and 18 mm spark plug holes.

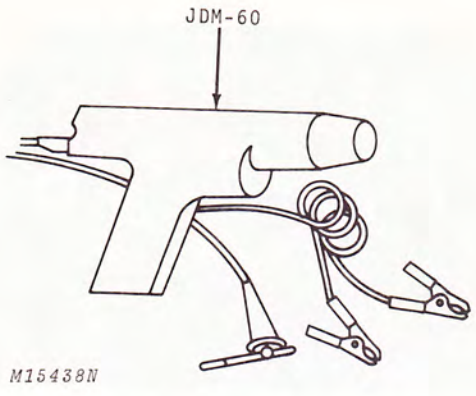

Fig. 11-JDM-60 Power Timing Light

For Kohler Engines

JDM-60 Power Timing Light, Fig. 11, is used to quickly and accurately establish timing.

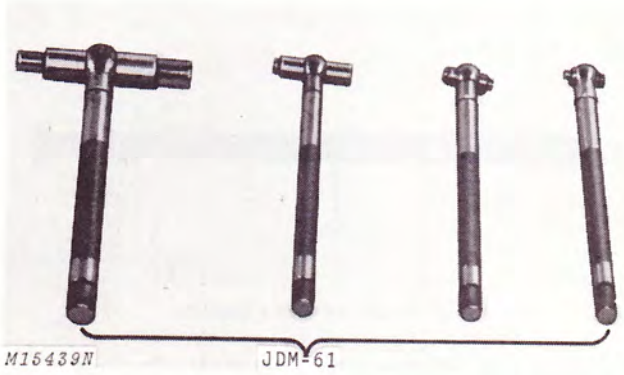

Fig. 12-JDM-61 Telescoping Gauge Set

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-61 Telescoping Gauge Set, Fig. 12, measures inside dimensions from 5/16 inch to 2-1/8 inches.

Dial Caliper JDM-57 is used to read the dimension.

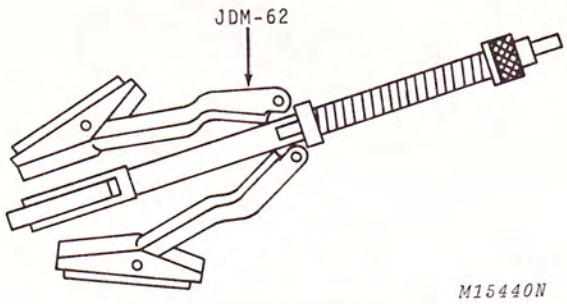

Fig. 13-JDM-62 Glaze Breaker

For Kohler Engines

JDM-62 Glaze Breaker, Fig. 13, is used with an electric drill to deglaze cast iron cylinder walls to assure positive ring seating. It fits all cast iron cylinders from 2 to 5-1/4 inches (50.80 mm to 1.33 cm).

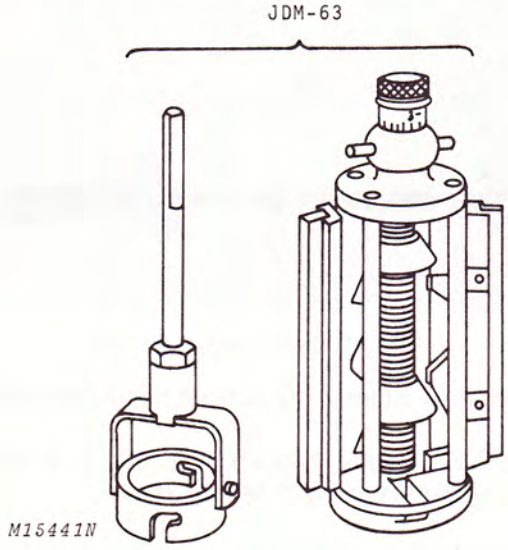

Fig. 14-JDM-63 Cylinder Hone Set

For Tecumseh and Kohler Engines

JDM-63 Cylinder Hone Set, Fig. 14, hones cylinder bore in cast iron engines. Set includes the following:

Roughing Stone Set

Medium Stone Set

Fine Stone Set

12 Ounces of Honing Oil

Fig. 15-JDM-63A Small Engine Hone Set

For Briggs & Stratton and Tecumseh Engines

JDM-63A Small Engine Hone Set, Fig. 15, hones cylinder bore in aluminum or cast iron engines. Set includes the following:

Roughing Stone Set (Cast Iron Engines)

Finishing Stone Set (Cast Iron Engines)

Stone Set (Aluminum Engines)

12 Ounces of Honing Oil

Fig. 16-Continuity Tester

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-14 Continuity Tester, Fig. 16, is used to locate open or closed electrical circuits.

Litho in U.S.A.

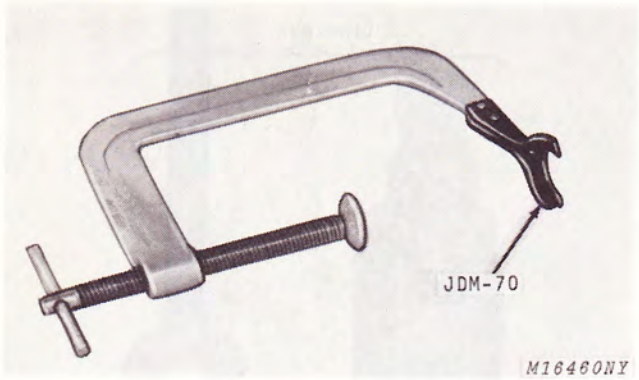

Fig. 17-JDM-70 Valve Spring Compressor

For Briggs & Stratton and Kohler Engines

JDM-70 Valve Spring Compressor, Fig. 17, compresses valve springs to remove or install intake and exhaust valves.

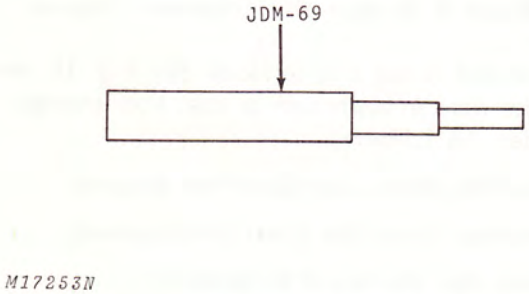

Fig. 18-JDM-69 Valve Guide Driver

For Kohler Engines

JDM-69 Valve Guide Driver, Fig. 18, makes removing and installing valve guides easier.

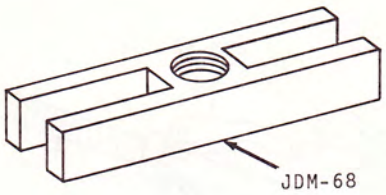

Fig. 19-JDM-68 Flywheel Puller

For Kohler Engines

JDM-68 Flywheel Puller, Fig. 19, is a general purpose puller used to remove the flywheel. It also works in balancers and gears having two or three tapped holes.

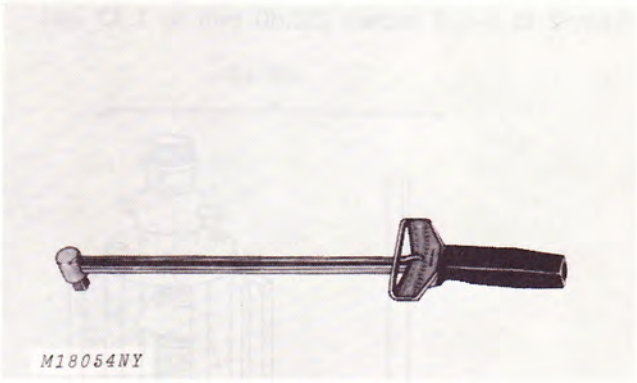

Fig. 20-JDST-27 Torque Wrench

For Briggs & Stratton, Tecumseh and Kohler Engines

JDST-27 Torque Wrench, Fig. 20, is a bending beam-type measuring 0 to 200 in-lbs.

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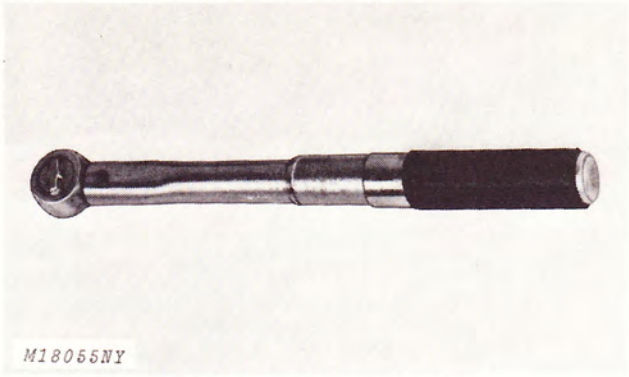

Fig. 21-T-4B Torque Wrench

For Briggs & Stratton, Tecumseh and Kohler Engines

T-4B Torque Wrench, Fig. 21, is a micrometer-type, measuring 10 to 250 ft-lbs. It reads in metric and English.

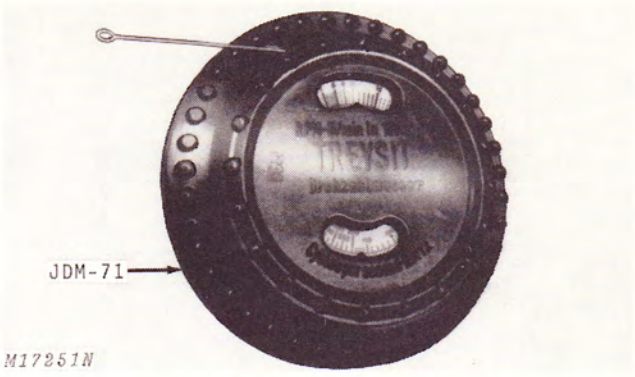

Fig. 22-JDM-71 Vibration Tachometer

For Briggs & Stratton, Tecumseh and Kohler Engines

JDM-71 Vibration Tachometer, Fig. 22, measures speeds from 800 to 25,000 rpm.

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Group 10
TRACTOR CONVENIENCE SERVICE TOOLS

TRACTOR CONVENIENCE SERVICE TOOLS

The tractor convenience service tools listed in this group are strictly for the convenience of the mechanic. They are not required, but they will make the job quicker and easier.

They can be ordered from:

Service Tools
Division of Owatonna Tool Company
P.O. Box 314
Owatonna, Minnesota 55060

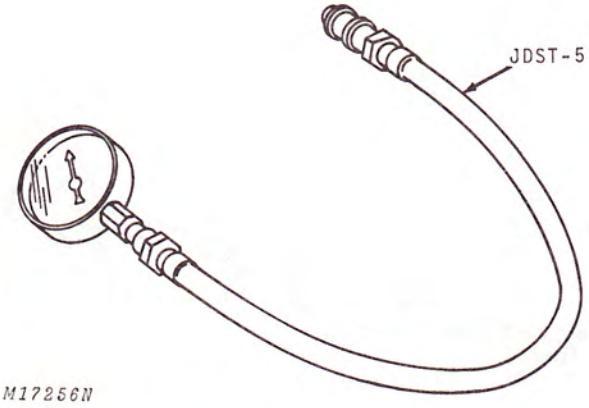
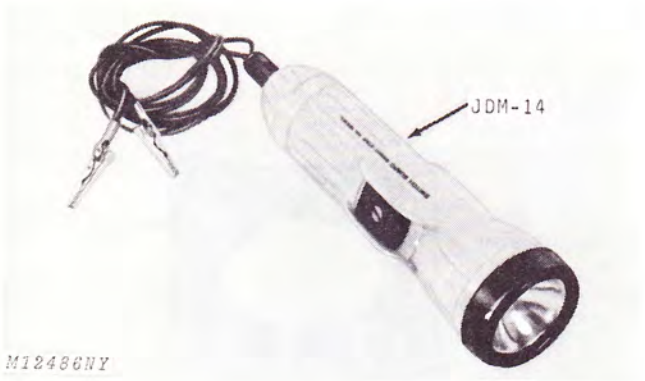


Fig. 1-JDST-5-G Oil Pressure Gauge

JDST-5-G Oil Pressure Gauge, Fig. 1, registers oil pressure from 0 to 1000 psi in 25 psi increments.



M12486NY

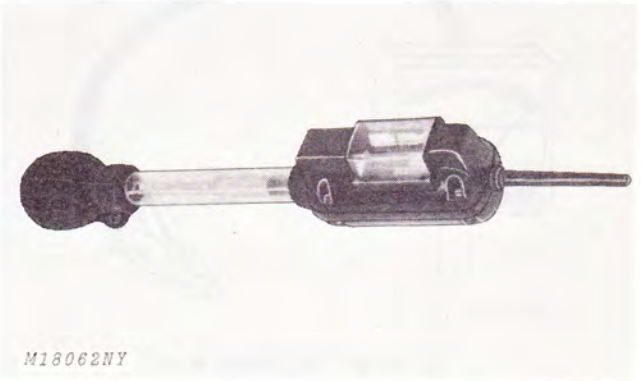
Fig. 2-JDM-14 Continuity Tester

JDM-14 Continuity Tester, Fig. 2, is used to locate open or closed electrical circuits.

M18061NY

Fig. 3-JDST-12 Multimeter

JDST-12 Voltmeter, Fig. 3, reads AC or DC voltage and ohms. Use it for checking electrical systems line voltage.



M18062NY

Fig. 4-521-TB Hydrometer

521-TB Hydrometer, Fig. 4, quickly tells the general condition of the battery.

M18063NY

Fig. 5-Mercontronic 98A Analyzer

Mercontronic 98A Analyzer, Fig. 5, tests the complete electrical system on any type of equipment.

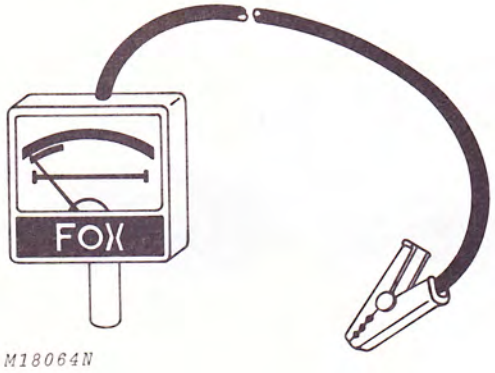
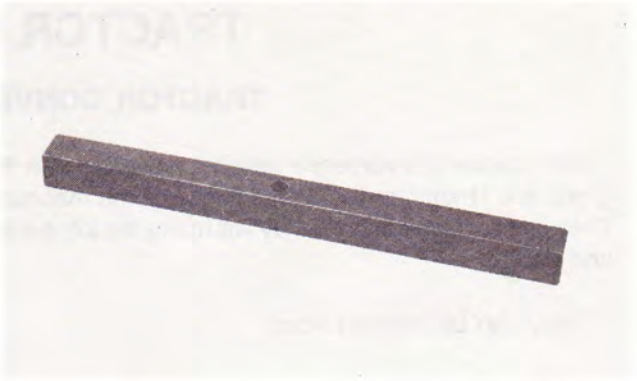


Fig. 6-240B Fox Battery Tester

240B Fox Battery Tester, Fig. 6, features a 200 amp discharge to check weak batteries. It also can check battery charge, alternator output, starter draw and shorts or leaks in electrical wiring.



M28918

Fig.7-JDST-10A Pinion Depth Gauge

JDST-10A, Fig. 7, is used with JDM-57 to measure differential pinion gear depth.

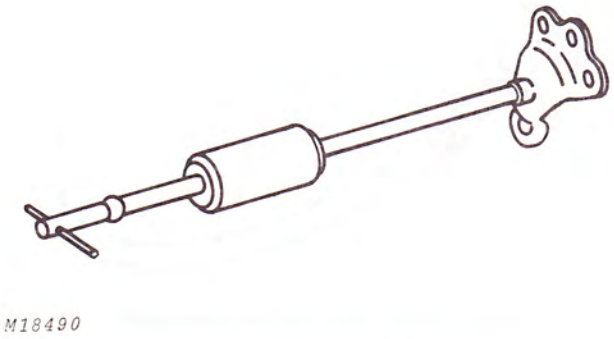
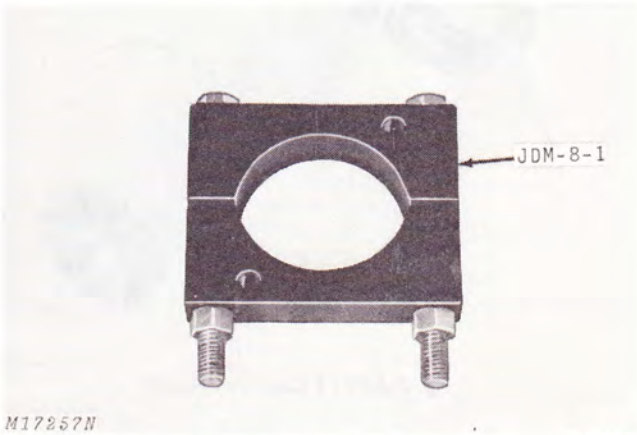


Fig. 8-OTC-967-C Brake Drum Puller

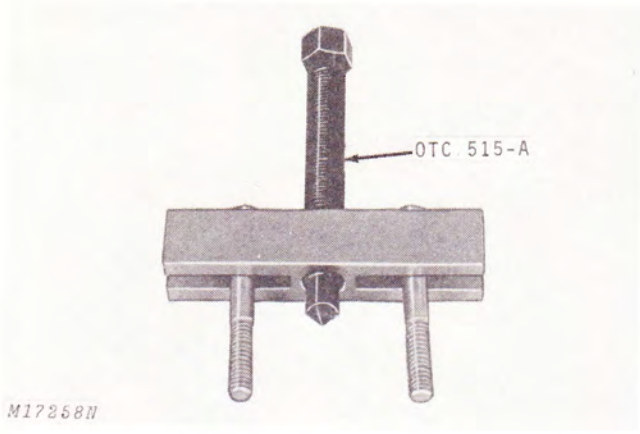
OTC-967-C Brake Drum Puller, Fig. 8, is used to remove the brake drum.



M17257N

Fig. 9-JDM-8-1 Puller

JDM-8-1 Puller, Fig. 9, is used with OTC 515-A Puller, Fig. 10, to remove steering wheel.



M17258N

Fig. 10-OTC 515-A Puller

OTC 515-A Puller, Fig. 10, is used in conjunction with JDM-8-1 Puller, Fig. 9, to remove steering wheel. It is also used to pull small gears and pulleys.

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Section 90
TRACTOR ATTACHMENTS

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49 SNOW THROWER

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ROTOR DRIVE CHAIN

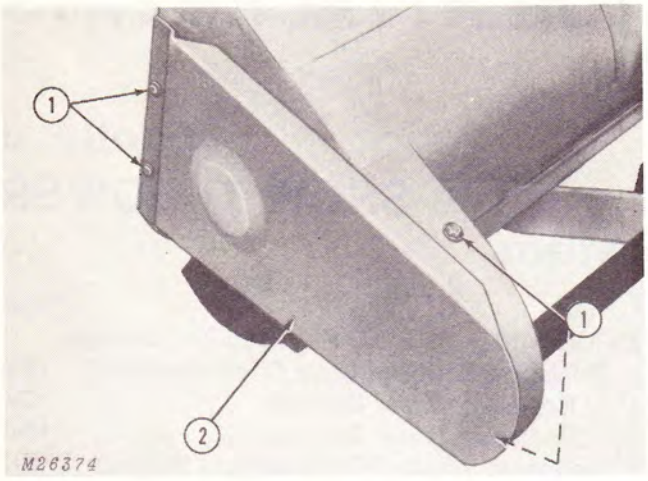

Fig. 1-Removing Drive Chain Shield

1. Remove two carriage bolts and two cap screws, Fig. 1.

2. Remove drive chain shield.

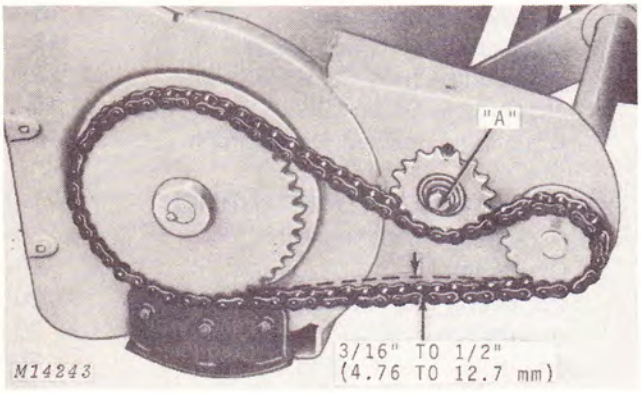

Fig. 2-Rotor Drive Chain

Check rotor drive chain tension by lifting chain upward midway between the two sprockets, Fig. 2. Deflection should be between 3/16 and 1/2 inch (4.76 and 12.7 mm) when chain is properly adjusted.

If adjustment is necessary, loosen bolt "A," Fig. 2, and slide idler up or down until proper tension is obtained. Tighten bolt "A" firmly after adjustment.

To remove chain, loosen idler bolt "A" and remove chain.

REPLACING ROTOR BEARINGS OR ROTOR

Remove drive chain shield as shown in Fig. 1 at the left.

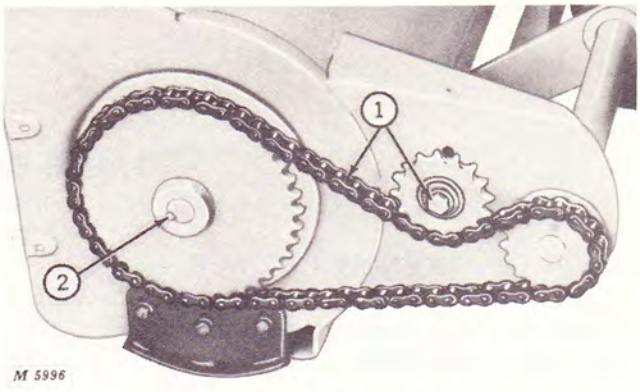

Fig. 3-Removing Drive Chain and Sprocket

1. Loosen chain idler bolt and remove chain, Fig. 3.
2. Loosen set screw and remove sprocket and key.

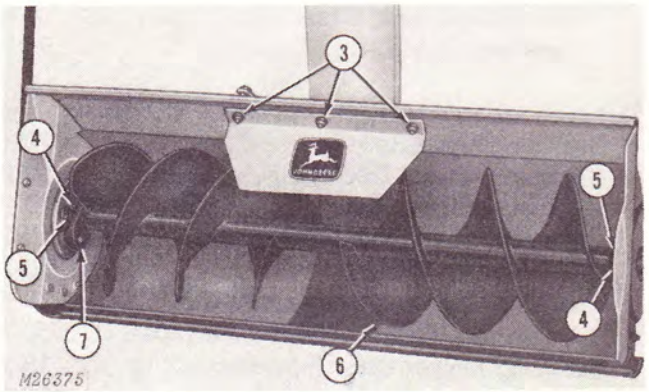

Fig. 4-Removing Deflector, Bearings and Rotor

3. Remove deflector, Fig. 4.
4. Loosen set screw in bearing collar on each end of snow thrower. Loosen collars by turning opposite direction of rotor travel.
5. Remove three cap screws, bearing flangettes and bearings.
6. Slide rotor toward left-hand end of thrower and lift out.
7. Remove shear bolt in drive arm and slide rotor off shaft. If drive arm is to be removed, slide off key and shaft.

NOTE: Prior to installing rotor in housing, install drive arm with key on rotor shaft. See Step 7, Fig. 4, page 90-5-2.

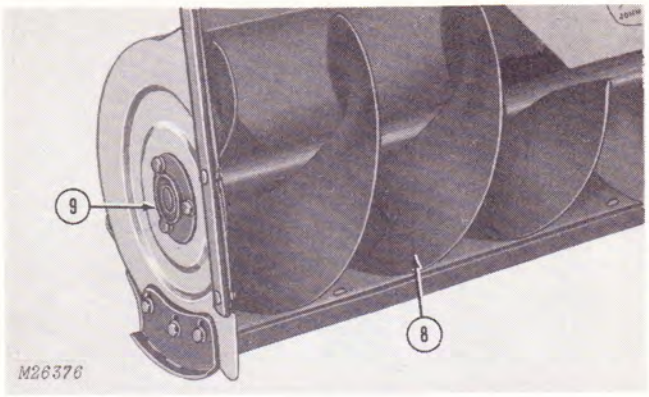

Fig. 5-Installing Rotor in Housing

8. Position rotor in snow thrower housing, Fig. 5.

9. Install bearings and bearing flangettes on each end of snow thrower with three cap screws.

IMPORTANT: Be sure end of rotor shaft is flush with end of bearing on right-hand side.

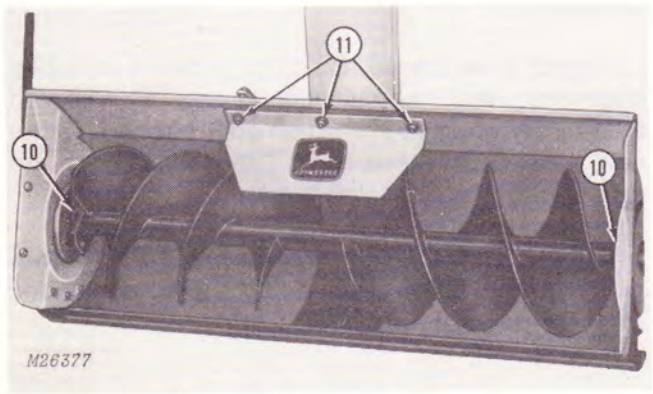

Fig. 6-Tightening Collars and Replacing Deflector

10. Turn collars on bearings and tighten in direction of rotor travel. Tighten set screws, Fig. 6.

11. Replace deflector with three bolts.

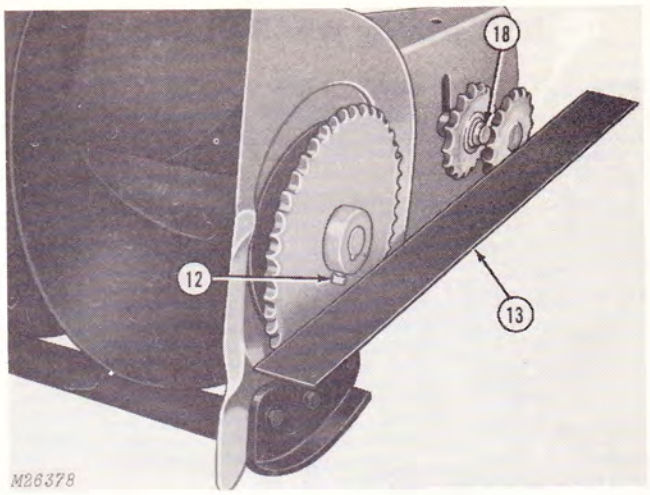

Fig. 7-Installing Sprockets

12. Install sprocket and key on rotor shaft, Fig. 7. Sprocket must be flush with end of shaft. Tighten set screw firmly.

13. Check to be sure sprockets are in alignment by placing a straightedge against the flat surface of each sprocket.

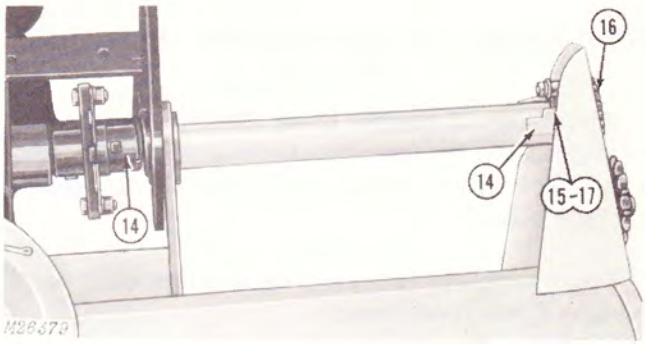

Fig. 8-Aligning Sprockets

14. If adjustment is necessary, loosen set screw in flexible coupler hub and countershaft bearing collar, Fig. 8.

15. Loosen collar by turning it opposite direction of rotor travel.

16. Slide countershaft either in or out until sprockets are in alignment.

17. Tighten collar on bearing by turning in direction of rotor travel. Tighten set screws.

18. If chain idler sprocket is not in alignment, Fig. 7, move sprocket on idler bolt. Shim as necessary to achieve proper alignment.

19. Install and adjust drive chain as shown on page 90-5-2, Fig. 2. Replace chain guard, Fig. 1.

IMPORTANT: If the flexible coupler bolts become loose or are removed for any reason, retighten the bolt to 29 ft-lbs (39.3 N·m) torque.

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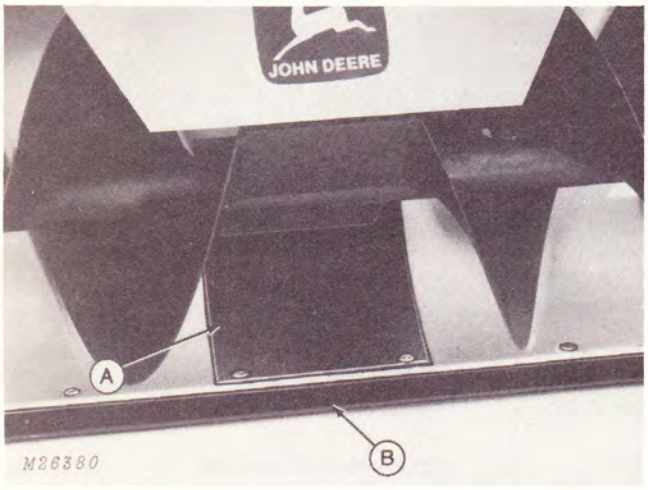
REPLACING WEAR PLATE



A—Wear Plate **B—Scraper Blade**

Fig. 9-Replacing Wear Plate

1. Remove three carriage bolts and slide wear plate (A), Fig. 9, out. Replace wear plate with bolts previously removed.

REPLACING OR REVERSING SCRAPER BLADE

When edge of scraper blade (B), Fig. 9, becomes rough or worn, remove attaching carriage bolts and turn scraper blade end for end. Reinstall and tighten carriage bolts.

If scraper blade is worn on both sides or is bent, replace it with a new blade.

REPLACING SHEAR BOLT

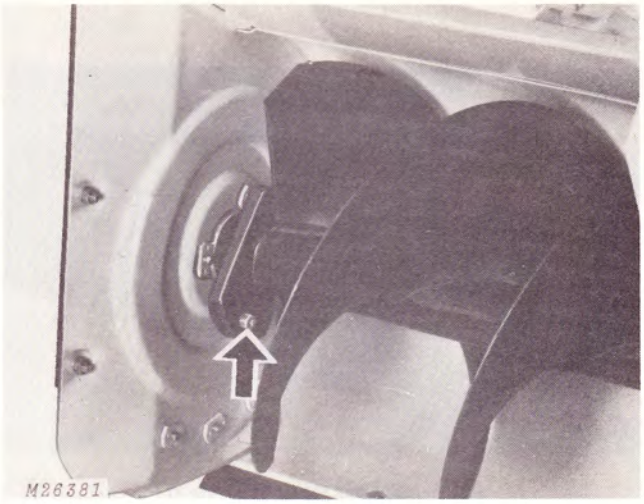


Fig. 10-Replacing Shear Bolt

If rotor fails to turn when PTO is engaged, check for a broken shear bolt, Fig. 10.

CAUTION: Place PTO switch in "OFF" position, stop engine and set parking brake before adjusting or replacing parts on snow thrower.

Inspect snow thrower for damage before replacing shear bolt. Repair any damage to snow thrower and then remove broken shear bolt and replace it with a new John Deere shear bolt. Extra shear bolts are stored in the chute control bracket.

IMPORTANT: Always replace shear bolt with a genuine John Deere shear bolt. Otherwise, damage to snow thrower may occur.

SERVICING GEAR CASE

Removing Gear Case

Remove snow thrower from tractor.

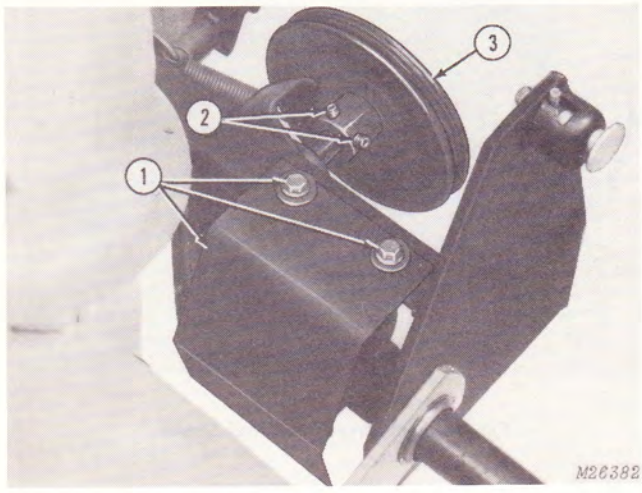


Fig. 11-Removing Shield and Sheave

1. Remove two screws, washers and shield, Fig. 11.

2. Loosen two set screws.

3. Remove sheave and key. If sheave is difficult to remove from shaft, remove gear case cover, Fig. 14, and retaining ring, Fig. 16, from gear shaft. Grasp sheave and pull shaft out of gear case.

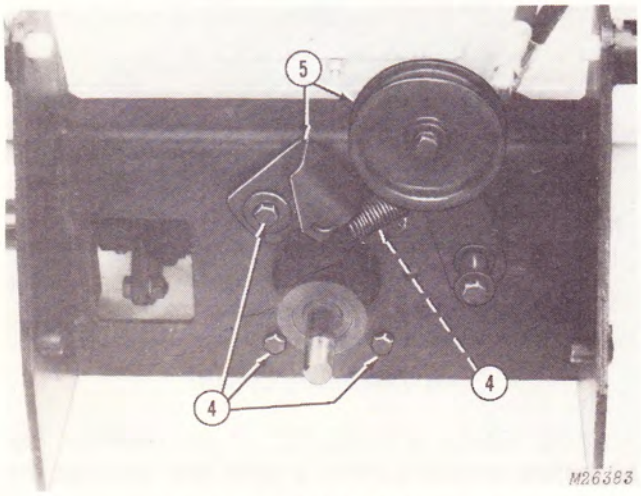


Fig. 12-Removing Gear Case Bolts

4. Remove four gear case mounting bolts, Fig. 12.

5. Place idler assembly out of way.

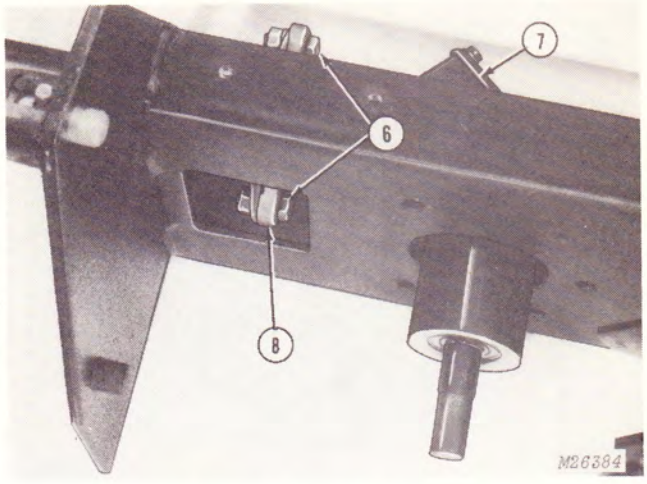


Fig. 13-Removing Gear Case

6. Remove two disk hub bolts, Fig. 13.

7. Remove gear case.

8. Remove hub and key from gear case output shaft.

Disassembling Gear Case

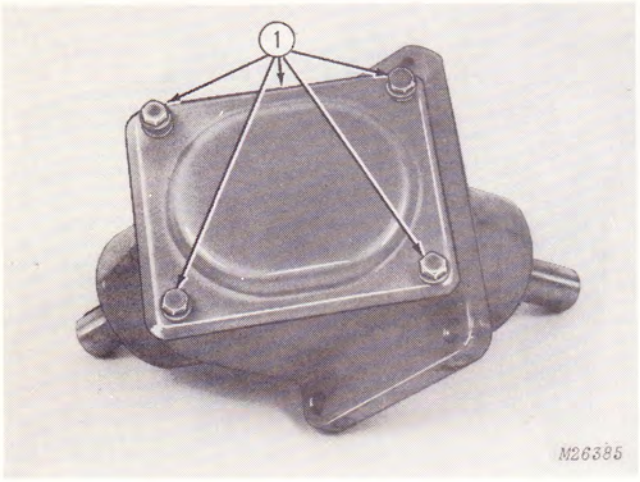


Fig. 14-Removing Cover

1. Remove four screws, cover and gasket, Fig. 14.

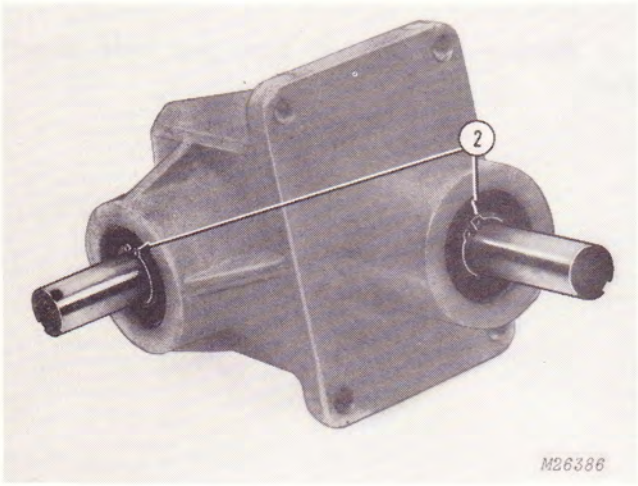


Fig. 15-Removing Retaining Rings

2. Remove retaining rings from shafts, Fig. 15.

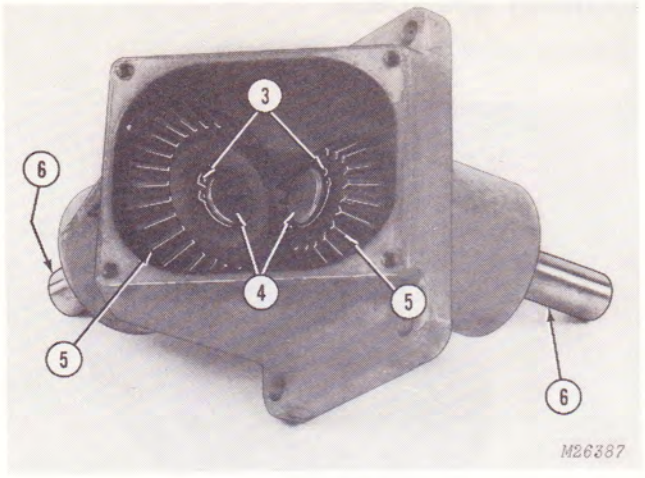


Fig. 16-Removing Gears and Shafts

3. Remove retaining rings, Fig. 16.

4. Press shafts out of gears.

5. Remove gears and keys.

6. Remove shafts from gear case.

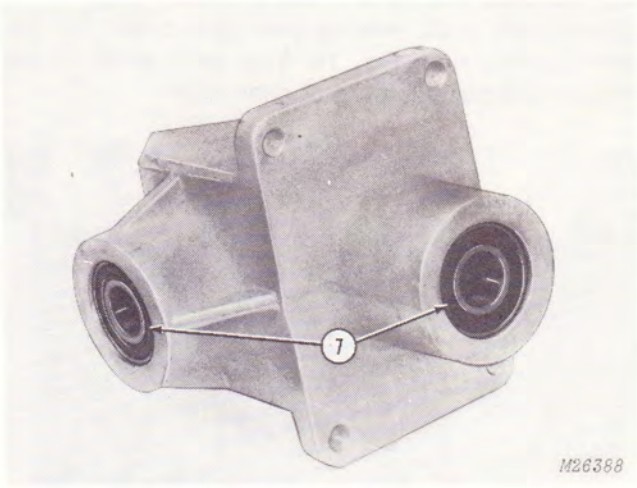


Fig. 17-Removing Oil Seals

NOTE: Check oil seals, Fig. 17, and bearings, Fig. 18, before removing them. If seals and bearings are not defective, do not remove them. Damage to oil seals will occur if they are removed from case.

7. Remove oil seals, Fig. 17, by prying them out with a screwdriver.

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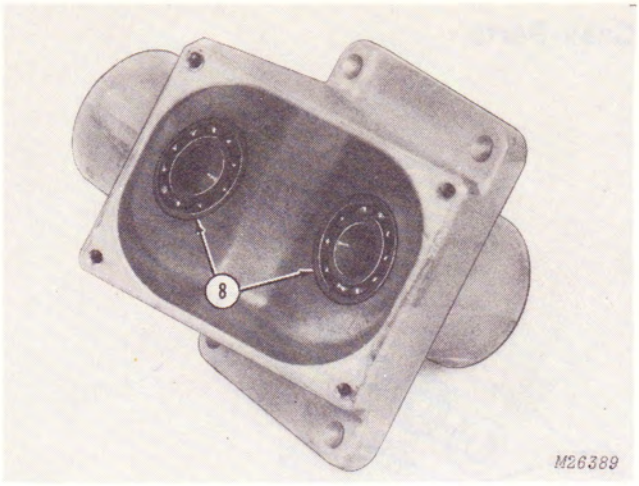

Fig. 18-Removing Bearings

8. Remove bearings by tapping them out of case with a punch, Fig. 18.

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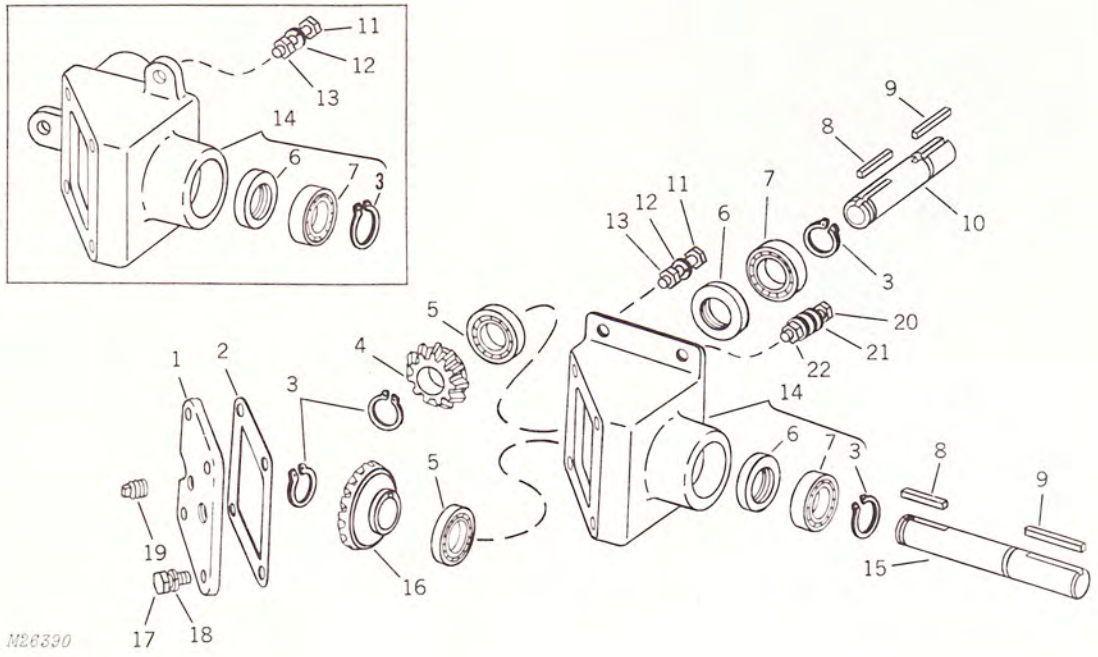
Inspecting Gear Case Parts



Key	Description	Key	Description
1	*Cover	12	3/8" Lock Washer
2	Gasket	13	3/8" Hex. Nut
3	Snap Ring (4 used)	14	Gear Case Housing
4	20-Tooth Pinion Gear	15	Output Shaft
5	Bearing (2 used)	16	30-Tooth Gear
6	Seal (2 used)	17	Screw (4 used)
7	Bearing (2 used)	18	1/4" Lock Washer (4 used)
8	3/16" x 3/4" Square Key	19	*Pipe Plug
9	3/16 x 1-3/8" Square Key	20	3/8" x 1-3/4" Cap Screw
10	Input Shaft	21	3/8" Lock Washer
11	3/8" x 1-1/4" Cap Screw	22	3/8" Hex. Nut

Fig. 19-Exploded View of 49 Snow Thrower Gear Case

**NOTE: 49 Snow Throwers below Serial No. 9276 are equipped with a different gear case housing illustrated in the box, Fig. 19. A different cover and pipe plug are also used.*

Inspect bearings (5 and 7), Fig. 19, for looseness and wear.

Inspect oil seals (6) for cracks or deterioration.

Inspect long input shaft (10) and short output shaft (15) for straightness.

Inspect gears (4 and 16) for worn or broken teeth.

Inspect gear case housing (14) for cracks.

Replace necessary parts.

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Assembling Gear Case

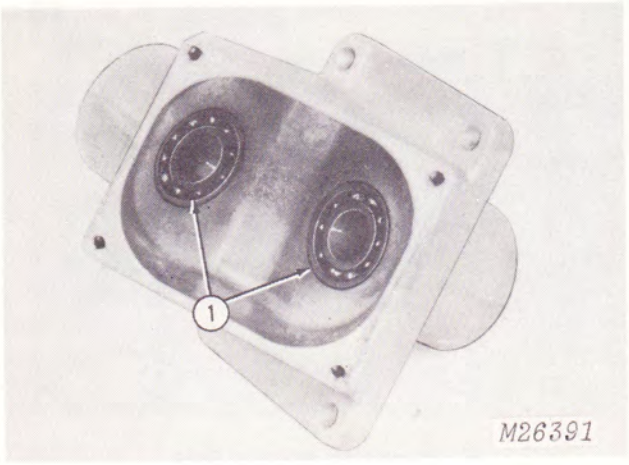

Fig. 20-Installing Bearings

1. Press bearings, Fig. 20, into gear case housing.

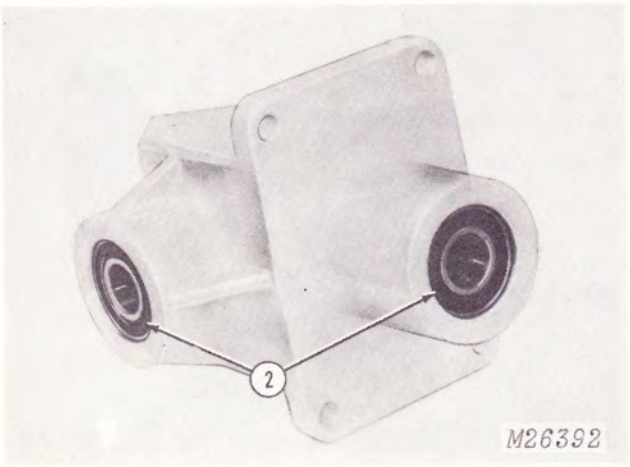

Fig. 21-Installing Oil Seals

2. Coat outside edges of oil seals with Permatex and press into gear case housing, Fig. 21.

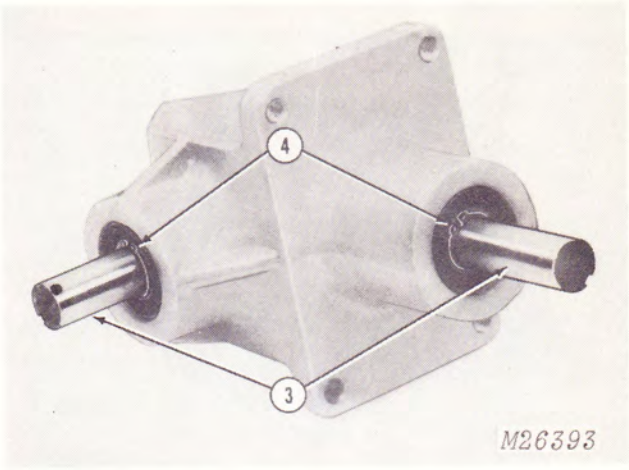

Fig. 22-Installing Gear Shafts

3. Coat gear shafts with oil and carefully slide them through seals and bearings, Fig. 22.

4. Install retaining rings on shafts.

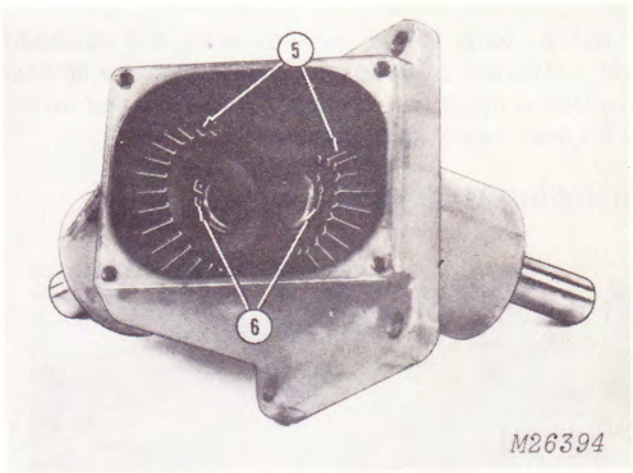

Fig. 23-Installing Gears

5. Install keys and gears on shafts, Fig. 23.

6. Install retaining rings.

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Assembling Gear Case—Continued

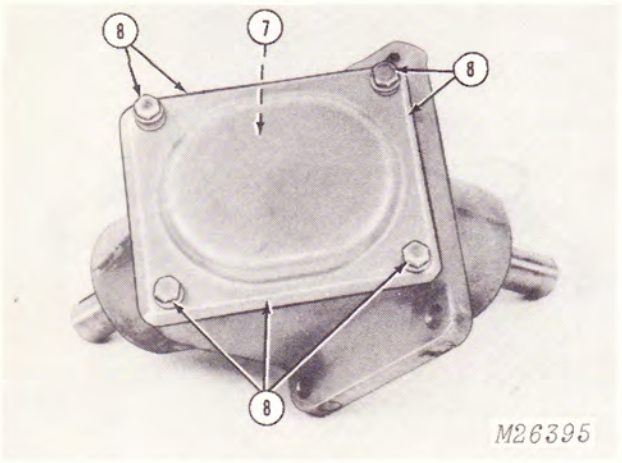

Fig. 24-Installing Cover

7. Place 3 ounces (89 mL) of John Deere AN102562 Corn Head Lubricant in gear case, Fig. 24.

8. Install gasket and cover with four screws and lock washers.

NOTE: Early model snow throwers are equipped with a different design gear case which has a fill plug installed in the cover. The gear case illustrated above is for later model snow throwers.

Installing Gear Case

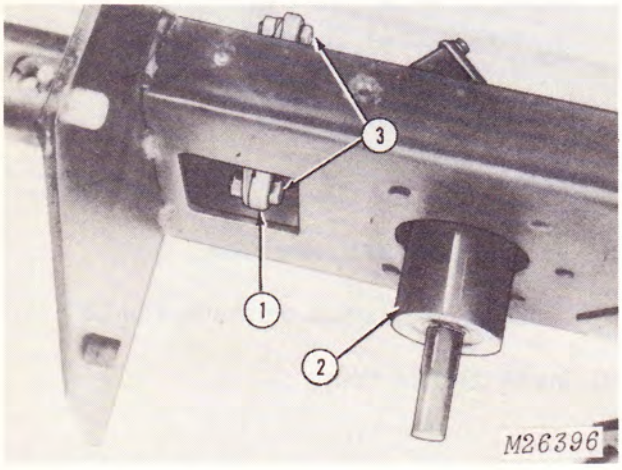

Fig. 25-Installing Gear Case

1. Install key and hub on gear case output shaft, Fig. 25.

2. Place gear case in position on thrower.

3. Secure hub to disk with two bolts.

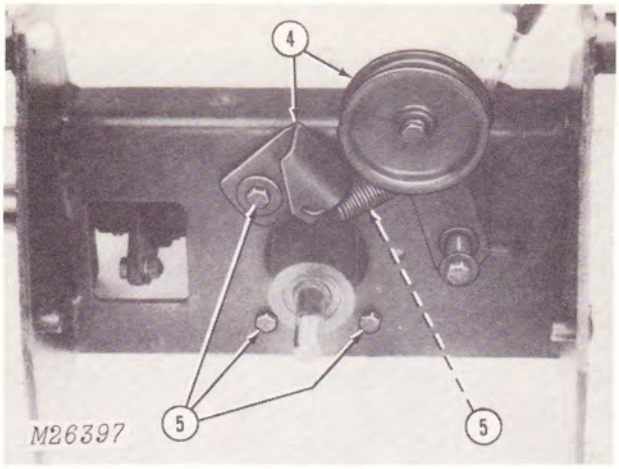

Fig. 26-Installing Mounting Bolts

4. Place idler assembly in position, Fig. 26.

5. Install four gear case mounting bolts tightly.

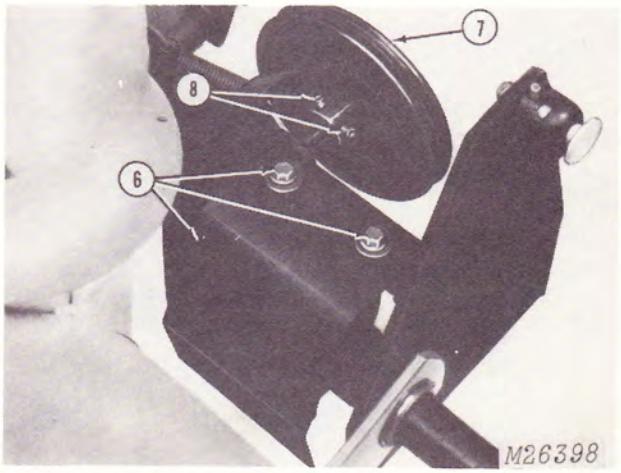

Fig. 27-Installing Shield and Sheave

6. Install shield with two screws and washers, Fig. 27.

7. Install key and sheave on gear case input shaft.

8. Apply Loctite on two set screws. Tighten set screws.

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Section 10
41 AND 48 ROTARY MOWERS

⚠ CAUTION: To prevent personal injury, disengage power, shut off engine, make sure blades have stopped revolving, and disconnect engine spark plug wires. Do not touch hot muffler or engine shrouds if engine has been running.

REPLACING DRIVE BELT

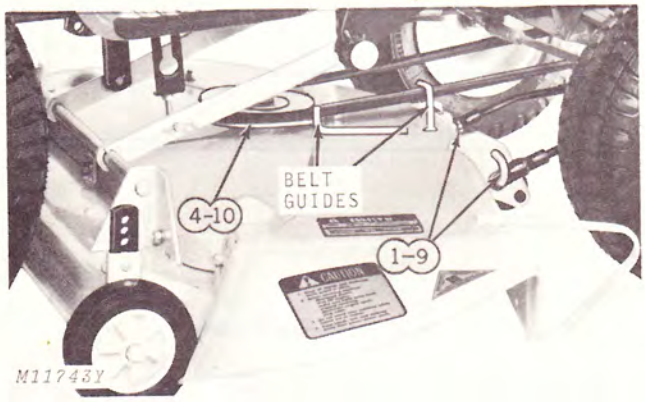

Fig. 1-Removing Front Draft Arms

Lower mower to surface.

1. Remove front draft arms, Fig. 1.

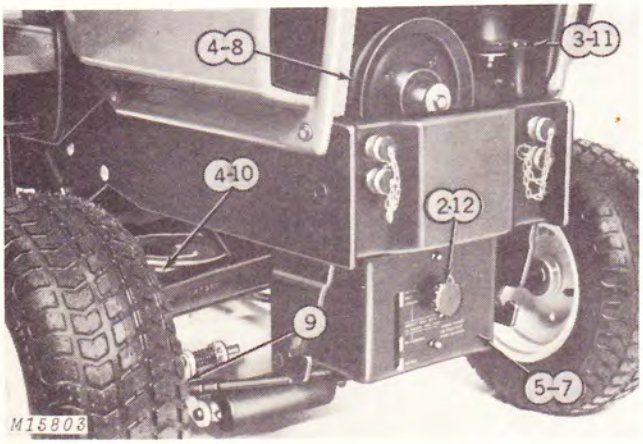

Fig. 2-Removing Drive Belt From Tractor

2. Turn draft plate knob counterclockwise until end of adjusting bolt is flush with inside of threaded hole in clevis, Fig. 2.

3. Remove tractor front grille. See "CAUTION" above.

4. Remove drive belt from mower drive sheave and engine PTO sheave.

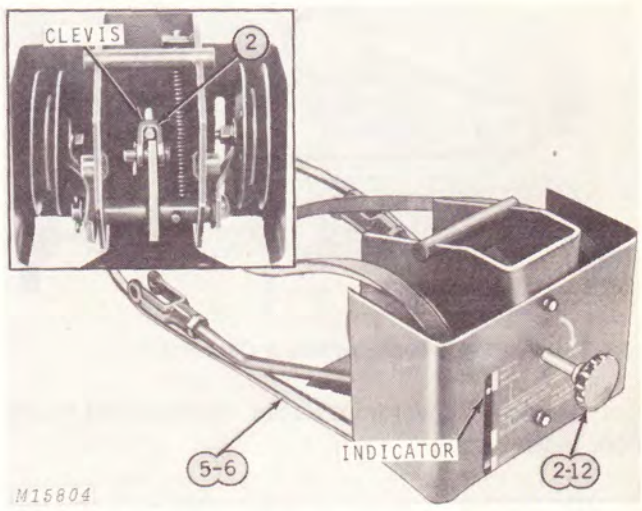

Fig. 3-Removing and Replacing Drive Belt

5. Lift up on front draft plate and slide lugs out of attaching slots in tractor brackets, Fig. 3. Remove belt from draft plate sheaves.

6. Slip new drive belt around draft plate sheaves. Be sure V-side of belt is in sheave groove.

IMPORTANT: Lubricate idler pivot with multi-purpose grease before installing new belt. Idler bracket should pivot freely.

7. Position draft plate and slide lugs into attaching slots in tractor brackets, Fig. 2.

8. Position belt around engine PTO sheave. Lay opposite end of belt on mower deck.

9. Attach front draft arms.

10. Install belt around mower drive sheave. Be sure belt is inside belt guides on 48 Mower.

IMPORTANT: Check to be sure belt is still properly installed on front draft plate sheaves and engine PTO sheave.

11. Replace tractor front grille.

12. Raise mower and turn knob clockwise on front draft plate until indicator points to "Initial Belt Tension."

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REPLACING MOWER DECK BELT

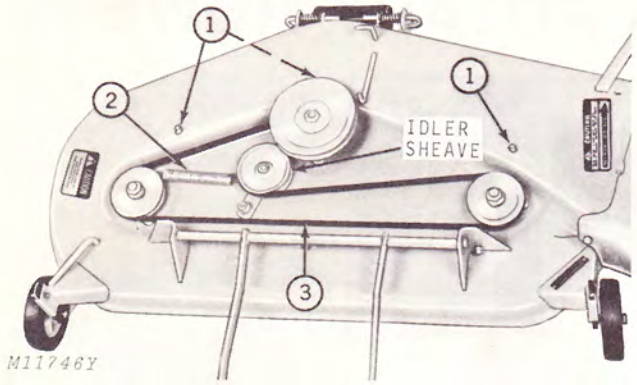


Fig. 4-Replacing Mower Deck Belt

1. Remove mower from tractor. Remove belt shield from mower deck.

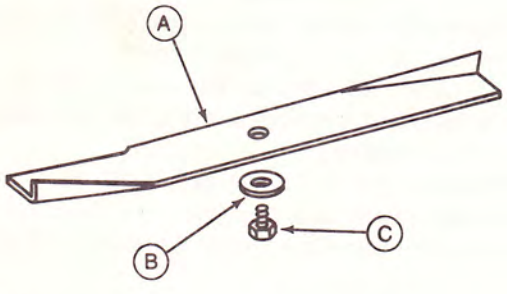
IMPORTANT: Clean out grass clippings and dirt before installing new belt. Be sure idler sheave bracket pivots freely.

2. Check condition of idler spring. Replace spring if it is stretched or worn. A faulty spring could cause belt slippage.

3. Position new belt into sheaves as shown above and replace belt shield.

SERVICING MOWER BLADES

Removing and Installing Blades



A—Blade **B—Washer** **C—Cap Screw**

Fig. 5-Removing and Installing Blades

1. Wrap a rag around sharp edge of blade and hold it with one hand while removing cap screw (C), Fig. 5.

2. Remove cap screw, washer (B) and blade (A).

3. Sharpen blade, Fig. 6, or replace it if it is bent or extremely worn.

IMPORTANT: Tighten cap screw (C) to 50 to 58 ft-lbs (67.8 to 78.6 N·m) torque when reinstalling blade, Fig. 4.

Sharpening Blades

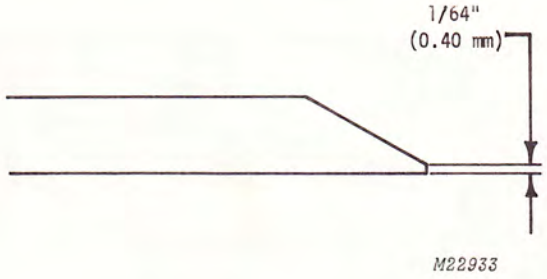


Fig. 5-Sharpening Blades

Sharpen blade leaving a 1/64 inch (0.40 mm) dull tip on cutting edge, Fig. 5.

A razor sharp cutting edge will roll over and dull quickly. Maintain original bevel. Remove an equal amount of material from each end of blade to maintain proper balance. Replace blade if it is damaged or out of balance.

Balancing Blades with a Balancer

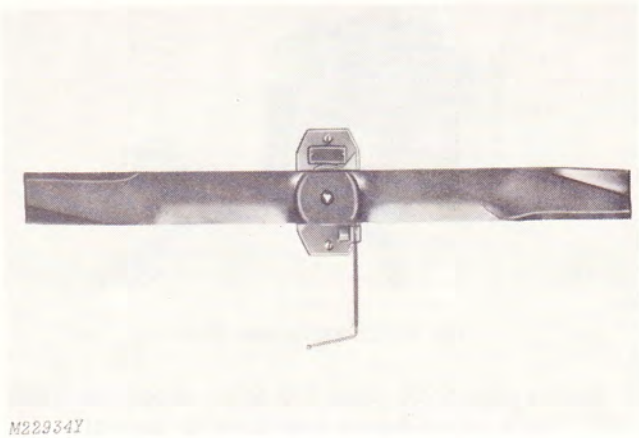


Fig. 6-Balancing Blades with a Balancer

1. Clean the blade thoroughly.

3. Set the blade horizontally on balancer, Fig. 6.

3. If the blade moves, metal must be ground off the end that moves down until it will balance. Adjust the track of the blades as shown in Fig. 7.

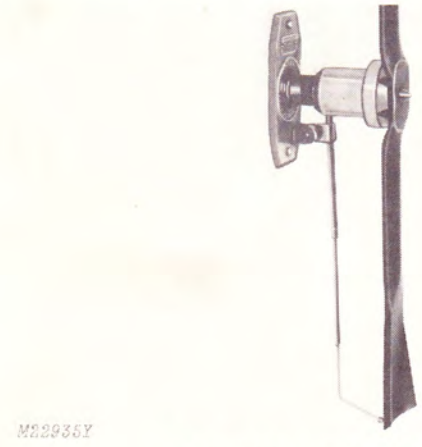


Fig. 7-Adjusting Blade Track

4. Adjust the track to just miss one tip of the blade, Fig. 7. Rotate the blade to check the opposite tip. If the difference is more than 1/16 inch (1.588 mm), replace the blade.

Balancing Blades without a Balancer

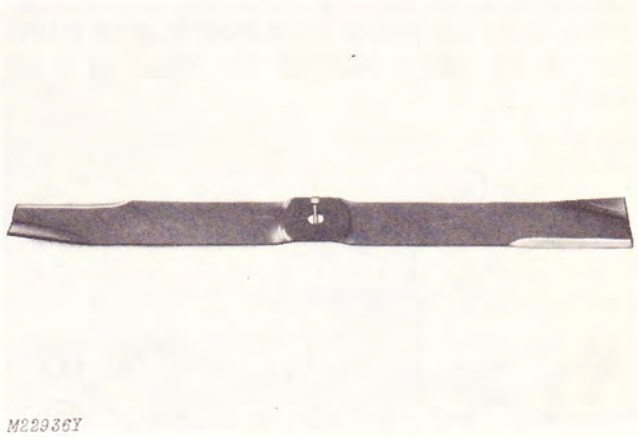


Fig. 8-Balancing Blades without a Balancer

1. Clean the blade thoroughly.

2. Set the blade horizontally on a nail, Fig. 8.

3. If the blade moves, metal must be ground off the end that moves down until it will balance.

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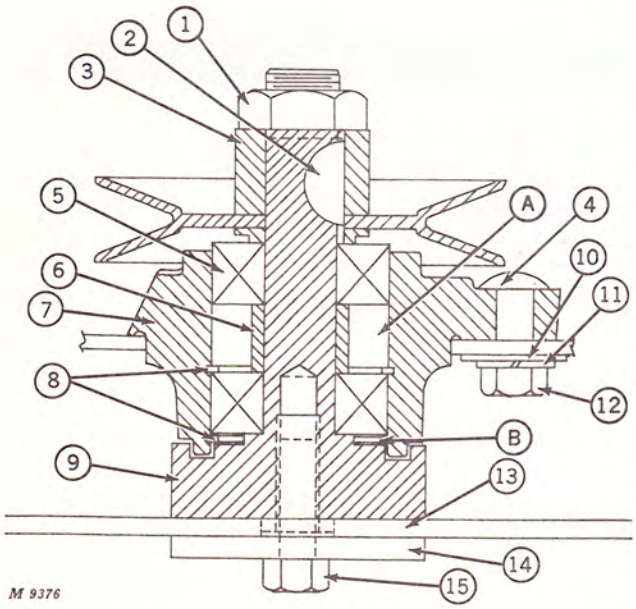
SERVICING MOWER BLADE SPINDLES

Mower spindles normally require no lubrication or service. If, for any reason the spindle must be disassembled, be sure to lubricate and torque parts as follows.



1—Lock Nut
2—Key
3—Driven Sheave
4—Bolt
5—Ball Bearing
6—Spacer
7—Hub
8—Snap Rings
9—Spindle
10—Washer
11—Lock Washer
12—Nut
13—Blade
14—Washer
15—Cap Screw

Fig. 9-Cutaway View of Spindle and Sheave

When assembling bearings and spacer, fill areas "A" and "B," Fig. 9, 75 per cent full of John Deere Multipurpose Lubricant or an equivalent SAE multipurpose-type grease.

Tighten lock nut (1), Fig. 9, to 120 ft-lbs (162.7 N·m) torque. Tighten cap screw (15) holding mower blade to spindle to between 50 and 58 ft-lbs (67.8 to 78.6 N·m) torque.

LUBRICATION

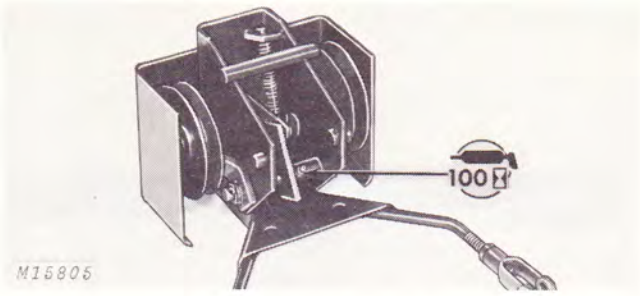


Fig. 10-Lubricating Idler Pivot

Grease idler pivot every 100 hours of operation with John Deere Multipurpose Lubricant or an equivalent SAE multipurpose-type grease, Fig. 10.

IMPORTANT: Be sure to clean fitting before and after lubrication to prevent grease from getting on belt.

Group 15
33 ROTARY TILLER

DRIVE BELTS AND SHEAVES

The primary drive system on the 33 Rotary Tiller consists of drive belts and sheaves. Therefore, it is important that sheaves be in alignment to prevent rapid belt wear and stress on the tractor drive parts. Be sure to check sheave alignment as explained below before replacing belts.

Checking Drive Sheave Alignment

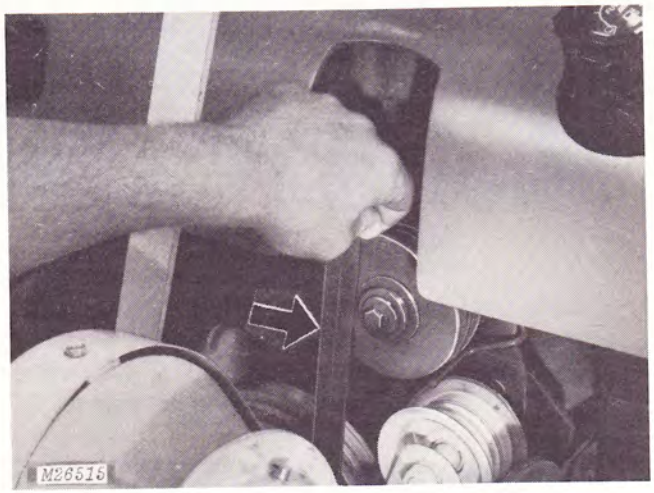


Fig. 1-Checking Drive Sheave Alignment

Before replacing drive belts, check sheave alignment.

Place a straightedge against sheaves, Fig. 1.

If drive sheave does not align with driven sheave, remove drive sheave and place washers on shaft as necessary. Two spacer washers (supplied with tractor PTO extension assembly) may be used on either side of drive sheave to align it with tiller driven sheave.

After sheaves are aligned properly, tighten cap screw in end of shaft securely.

IMPORTANT: If a sheave is bent or broken, replace it before replacing belts. Otherwise, belt damage will occur.

⚠ CAUTION: Never make adjustments or repair tiller with tractor engine running. Always stop tractor engine and set parking brake before dismounting from tractor. If tiller is to be worked on in the raised position, place blocks under it to keep it from falling.

Replacing Drive Belts

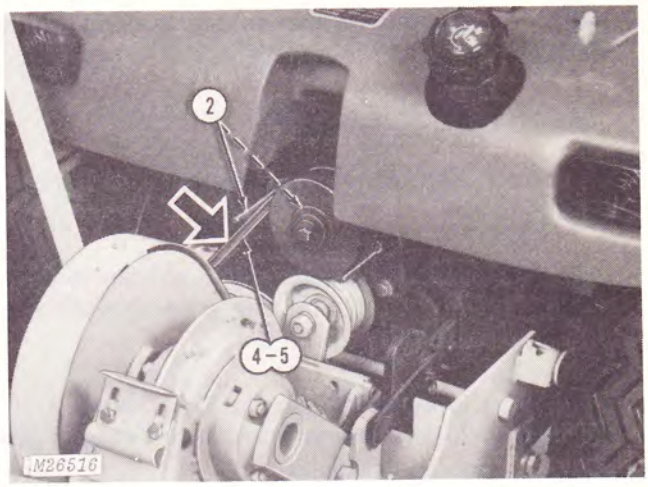


Fig. 2-Loosening Upper Belt Guide

1. Place tiller drive lever in disengaged position.
NOTE: The belt shield and guard are removed from tiller for illustrative purposes.
2. Loosen bolt securing upper belt guide.

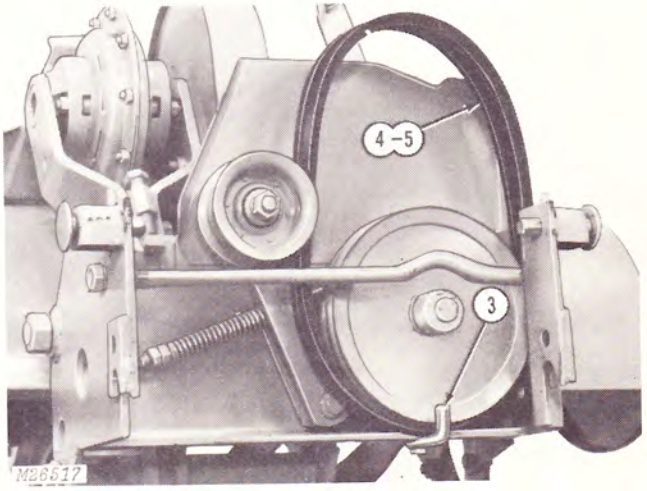


Fig. 3-Loosening Lower Belt Guide

3. Loosen bolt securing lower belt guide, Fig. 3.
4. Remove drive belts from sheaves, Figs. 2 and 3.
5. Install new drive belts on sheaves (one at a time).
6. Adjust belt guides as explained on page 90-15-2.

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DRIVE BELTS AND SHEAVES—Continued

Adjusting Belt Guides

IMPORTANT: Belt guides must be adjusted properly so tiller tines do not rotate when drive lever is disengaged.

CAUTION: Always stop tractor engine and set parking brake before making adjustments on tiller to prevent personal injury.

Adjust belt guides as follows:

1. Place tiller drive engagement lever in the engaged position.

2. Adjust upper belt guide, Fig. 2, so there is 3/16 to 1/4-inch (4.76 to 6.35 mm) clearance between guide and belt. Tighten belt guide bolt.

3. Adjust lower belt guide, Fig. 3, so there is 3/16 to 1/4-inch (4.76 to 6.35 mm) clearance between guide and belt. Tighten belt guide bolt.

IMPORTANT: After adjusting belt guides, check belt tension adjustment as explained at the right.

Adjusting Belt Tension

If drive lever engages easily or does not stay engaged, adjust belt tension spring, Fig. 5.

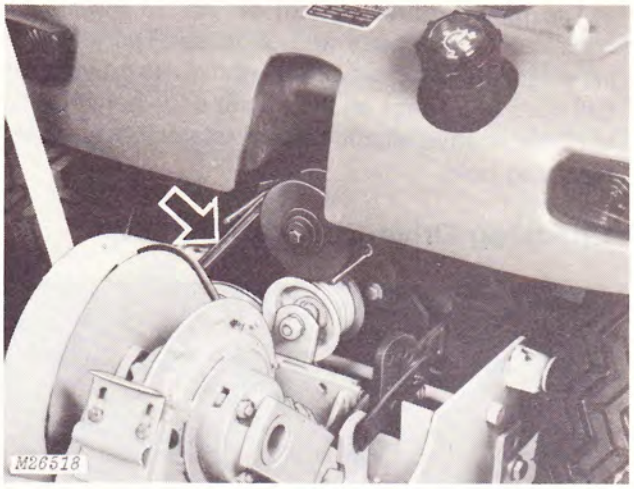

Fig. 4-Deflecting Belt

Drive belts should deflect 3/16 to 1/4-inch when a 20-pound (9.08 kg) pressure is applied to center span of belts between sheaves (arrow), Fig. 4. Drive lever should be engaged when checking deflection.

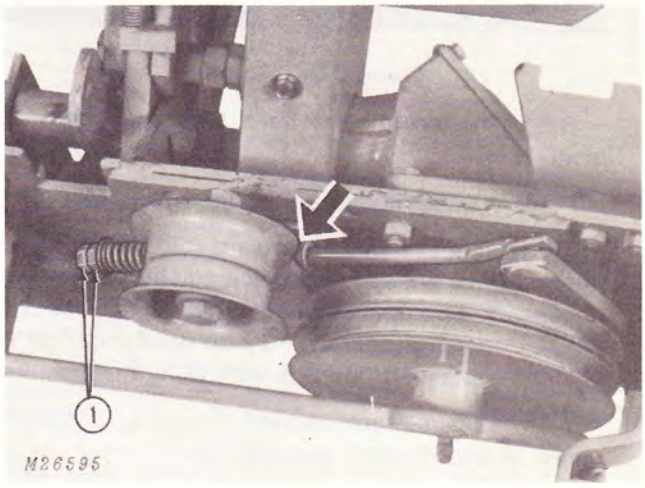

Fig. 5-Adjusting Belt Tension

1. Increase belt tension by loosening jam nut and turning adjusting nut on tension spring rod. Tighten jam nut after adjustment.

NOTE: If belts are still too loose, move stop collar (arrow) slightly on spring rod to allow idler to take up slack. Be sure idler sheave does not ride on driven sheave when idler bracket is against stop collar.

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EXTERNAL DRIVE CHAIN

Replacing External Drive Chain

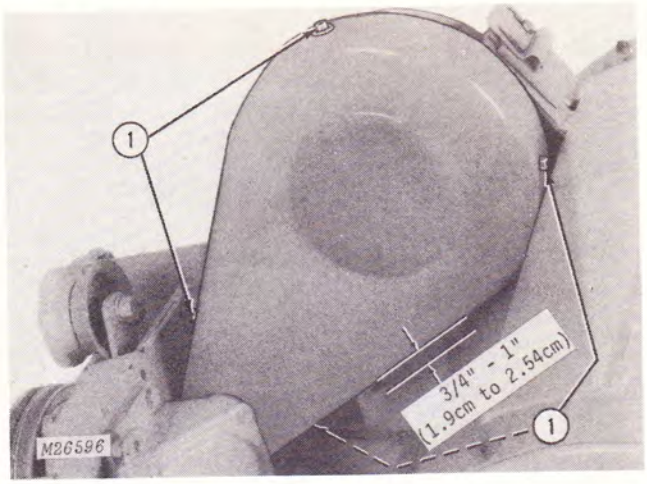

Fig. 6-Removing Shield

1. Remove four screws and drive chain shield, Fig. 6.

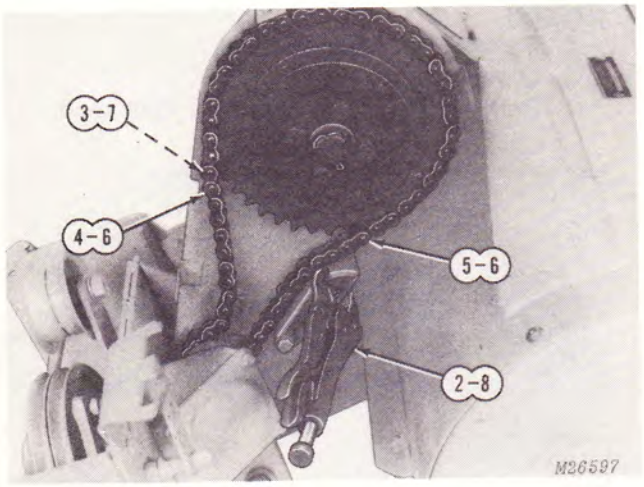

Fig. 7-Removing and Replacing Chain

2. Compress chain tightener, Fig. 7, with a locking pliers.
3. Remove spring clip on inside of chain.
4. Remove coupler link.
5. Remove drive chain.
6. Install new chain and connect with coupler link.

NOTE: If only one link is broken and chain is still in good shape, it can be repaired with service repair links.

7. Install spring clip on connector link so closed end of clip is facing direction of chain travel, Fig. 7.
8. Remove locking pliers from chain tightener.
9. Reinstall drive chain shield, Fig. 6.
10. Check drive chain adjustment as explained below.

Adjusting External Drive Chain Tension

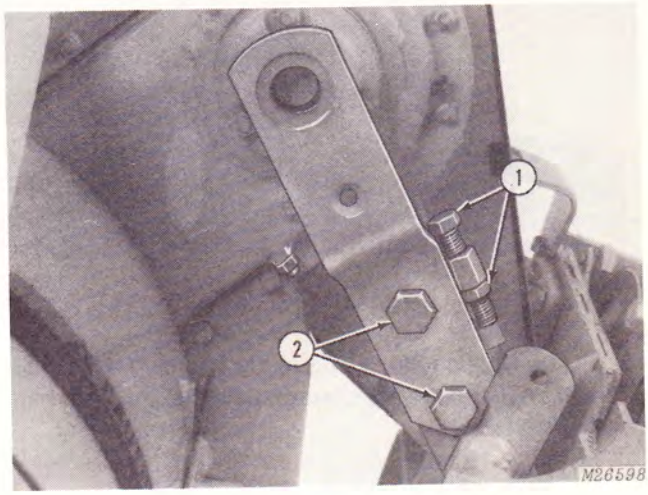

Fig. 8-Adjusting External Drive Chain Tension

The chain is properly adjusted when the distance between chain guard and cotter pin in end of chain tightener spring rod, Fig. 6, is between 3/4 and 1 inch (1.90 to 2.54 cm). If chain tightener spring is weak or broken, replace it before adjusting chain.

To adjust chain tension:

1. Loosen jam nut on link arm stop bolt, Fig. 8, and partially unscrew bolt.
2. Loosen lock nuts on link arm bolts enough to allow upper link arms to move.
3. Using a pry bar, move upper link arms upward until chain pushes chain tightener spring rod, Fig. 6, outward 3/4 to 1 inch (1.90 to 2.54 cm). Snug bolts up but do not tighten before checking to be sure tiller is level as shown on page 90-15-5. If tiller is level, tighten bolts.

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SLIP CLUTCH

Adjusting Slip Clutch

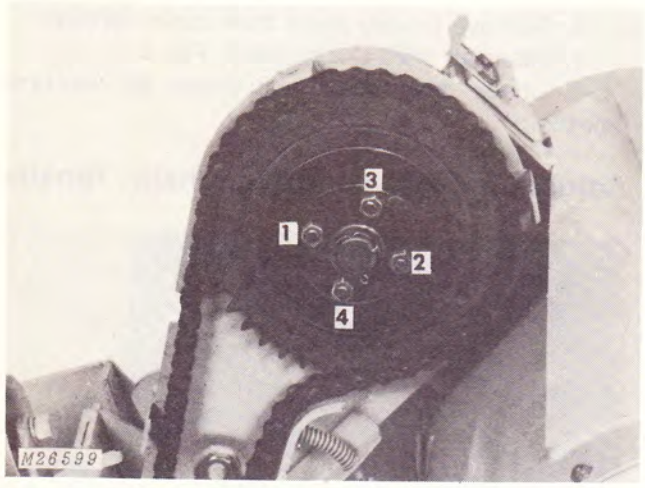


Fig. 9-Adjusting Slip Clutch

If tine rotation stops frequently and all other belt and chain adjustments are correct, adjust slip clutch, Fig. 9, as follows.

1. Remove drive chain shield, Fig. 6.

2. Loosen four adjusting nuts, Fig. 9, partially and then tighten nuts finger-tight.

IMPORTANT: Check to be sure clutch disks are centered over shoulder of bushing in sprocket before tightening adjusting nuts. Visually center spring washer on pressure plate.

3. Tighten each nut 1/2 turn at a time in sequence shown in Fig. 9. Tighten nuts a total of 2-1/2 turns.

If clutch slips after adjustment, replace clutch disks and spring washers, Fig. 10.

Replacing Clutch Disks and Spring Washers

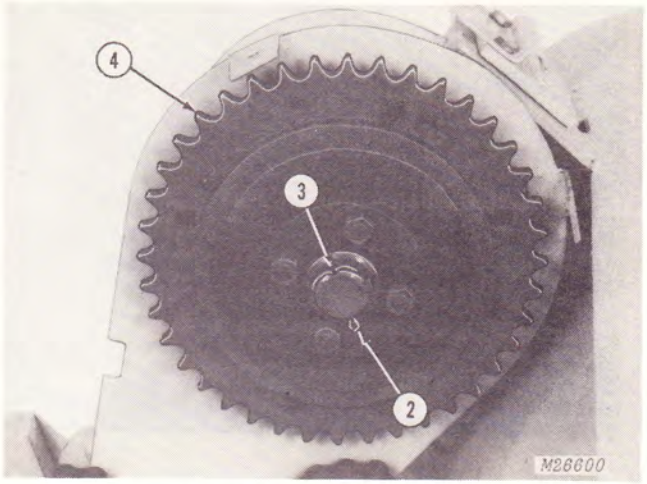
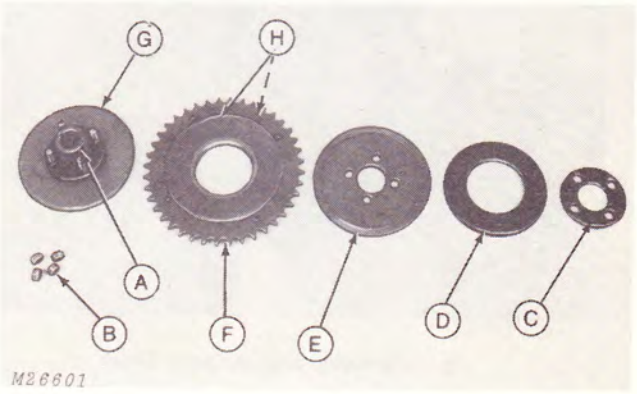


Fig. 10-Removing Slip Clutch

1. Remove drive chain shield, Fig. 6 and disconnect drive chain, Fig. 7. Remove drive chain from slip clutch sprocket.
2. Remove cotter pin, Fig. 10.
3. Loosen set screw.
4. Remove slip clutch assembly from shaft.



A—Set Screw
B—Nuts
C—Ring
D—Spring Washer
E—Plate
F—Bushing and Sprocket
G—Hub
H—Disks

Fig. 11-Disassembling Slip Clutch

1. Remove set screw (A) and four nuts (B), Fig. 11.
2. Remove ring (C), spring washer (D), plate (E), bushing and sprocket (F) from hub (G).
3. Remove and assemble new disks (H) and washers (D) on sprocket and bushing. Assemble other parts in reverse order of disassembly.
4. Reinstall clutch and chain, Fig. 10. Adjust clutch as explained on this page.

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LEVELING TILLER

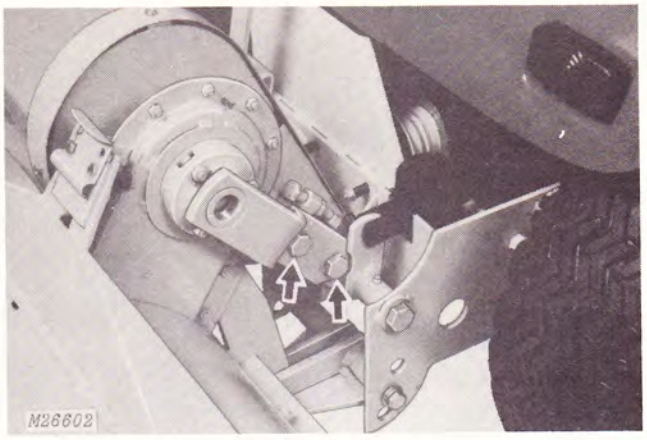

Fig. 12-Leveling Tiller

The tractor should be parked on a hard level surface.

After parking tractor, raise tiller to transport position and stop tractor engine. Block tiller in raised position.

Stand at the rear of the tiller and sight across the top of the tiller housing and rear of the tractor fender-deck.

If tiller is not level, loosen bolts, Fig. 12, on upper link arms and position tiller level with surface.

IMPORTANT: Be sure external drive chain is properly adjusted as explained on page 90-15-3 before tightening bolts.

Tighten bolts when tiller is leveled properly.

REPLACING TINES

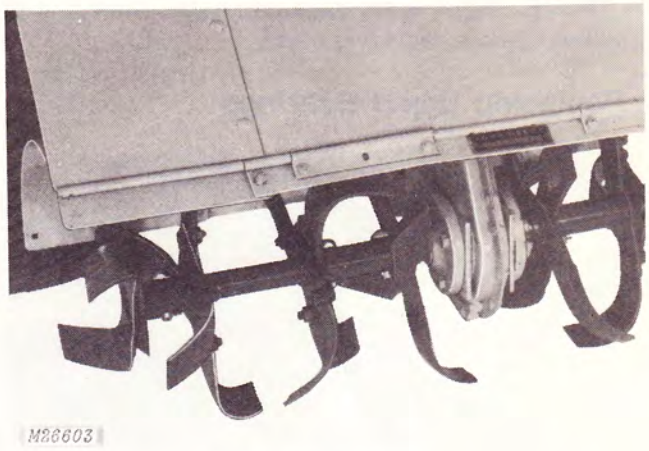

Fig. 13-Replacing Tines

The cutting edge of the tines must face the direction of rotation. The bend on each end of the tine will determine if it is a right or left-hand tine. If the bend is to the left, it is a left-hand tine. If the bend is to the right, it is a right-hand tine. Right and left hand reference to tines is determined by standing at the rear of the tiller and facing the direction of forward travel.

When extension tines are mounted on the left-hand side, the single blade will be toward the outside.

When extension tines are mounted on the right-hand side, the double blade MUST be toward the outside. Be sure tines are installed with cutting edges facing direction of rotation.

Refer to the operator's manual for tine extension pattern.

To replace tines, remove bolts securing tine to mounting. Install new tine with two bolts and tighten bolts.

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REPLACING ENCLOSED DRIVE CHAIN BEARINGS

NOTE: If tiller is mounted on tractor, lower it to the surface before removing parts.

Replacing Upper Bearings

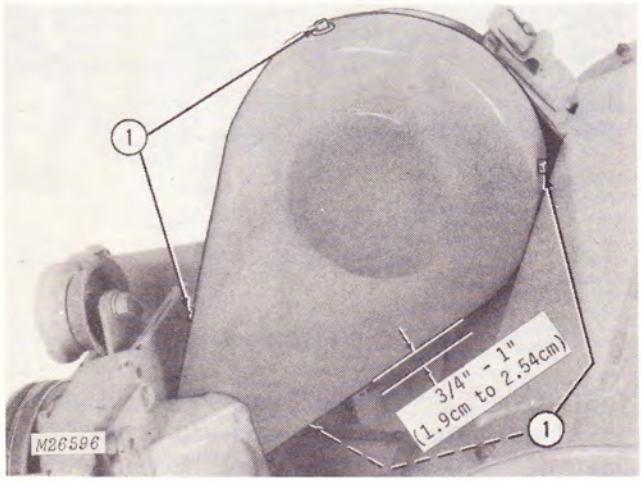

Fig. 14-Removing Drive Chain Shield

1. Remove four screws and shield, Fig. 14.

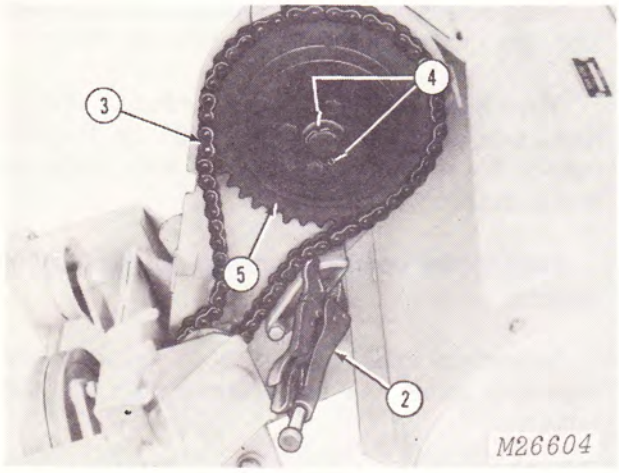

Fig. 15-Disconnecting Drive Chain

2. Compress chain tightener with a locking pliers, Fig. 15.

3. Remove spring clip from coupler link. Remove coupler link and chain from slip clutch sprocket.

4. Remove cotter pin and loosen set screw.

5. Pull slip clutch assembly off shaft.

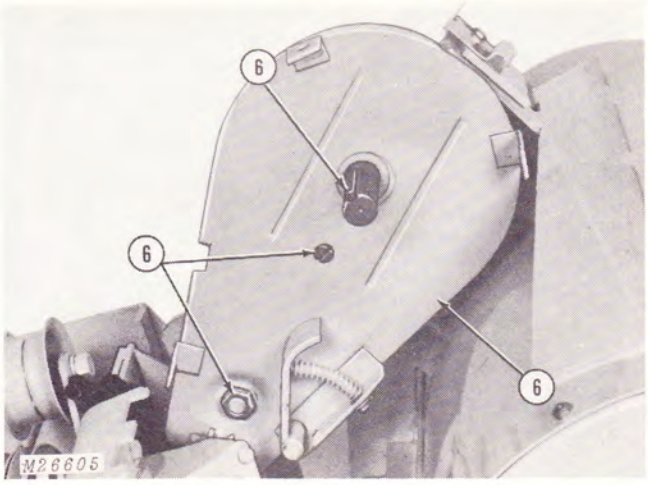

Fig. 16-Removing Chain Guard

6. Remove key from shaft, Fig. 16. Remove nut, flat head machine bolt and inner chain guard.

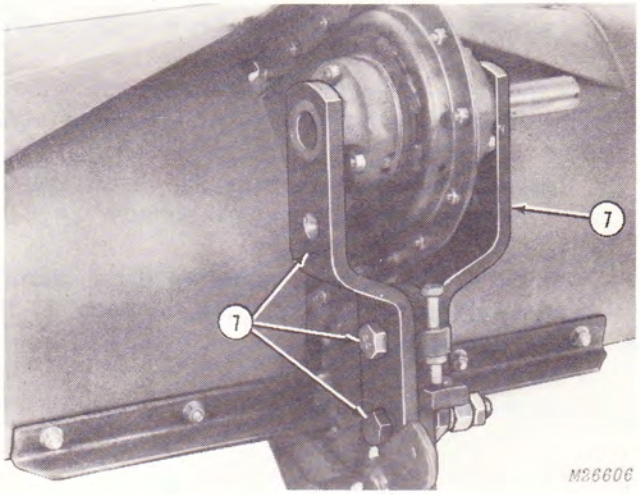

Fig. 17-Removing Link Arms

7. Remove two cap screws and link arms, Fig. 17.

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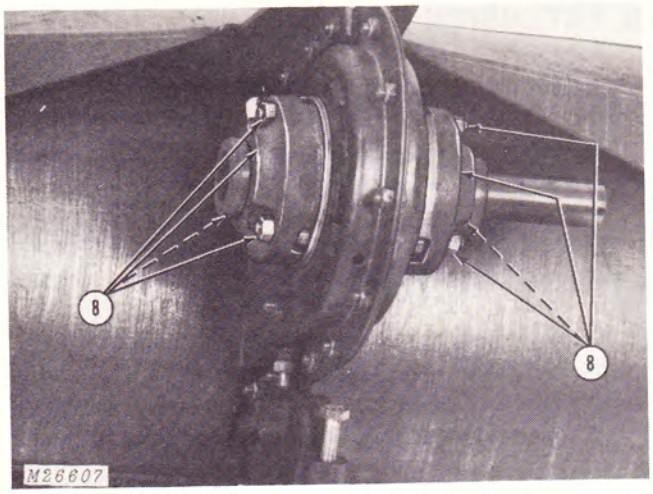

Fig. 18-Removing Pivot Hubs

8. Remove three nuts (each hub) and pivot hubs, Fig. 18.

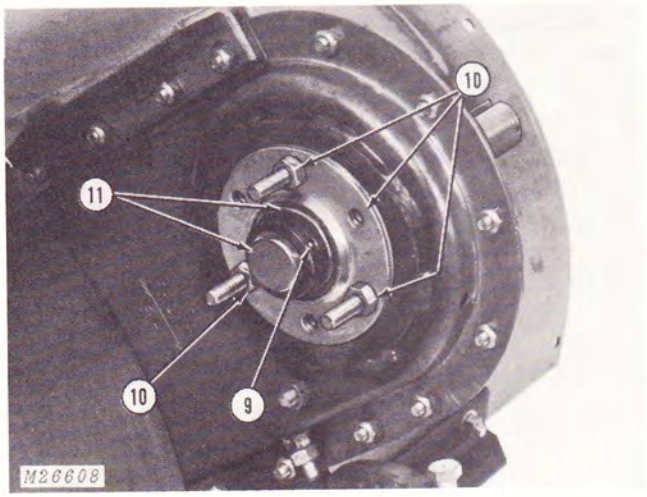

Fig. 19-Replacing Bearings

9. Loosen set screws in locking collars on each side of case, Fig. 19. Remove locking collars by turning them opposite direction of shaft rotation.

10. Remove three nuts and bearing flangettes on each side of case.

11. Clean shaft with emery cloth and remove bearings.

12. Replace upper bearings and other parts removed in reverse order.

IMPORTANT: Apply Loctite on threads of lower pivot link bolt, Fig. 17, before installing nut. Install and tighten nut after Loctite is applied.

Replacing Lower Bearings

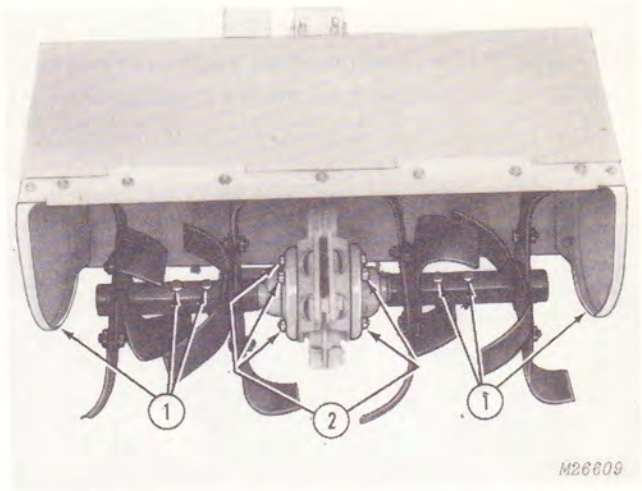

Fig. 20-Removing End Covers, Tines and Bearing Caps

1. Remove end covers and tine assemblies, Fig. 20.

2. Remove eight nuts and lower bearing caps.

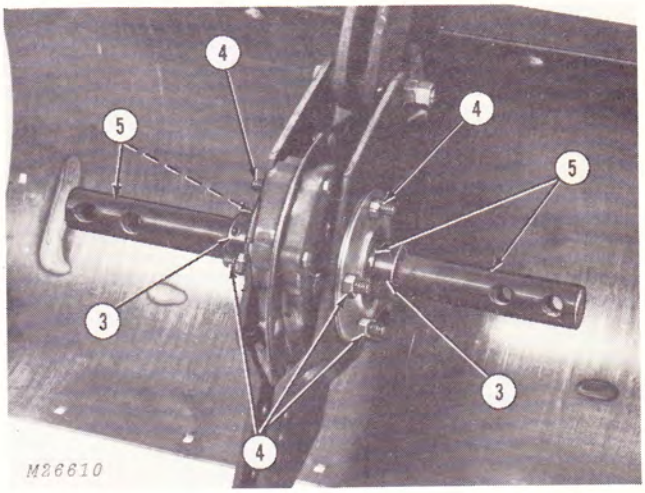

Fig. 21-Replacing Bearings

3. Loosen set screws in locking collars and remove collars, Fig. 21.

4. Remove nuts and bearing flangettes.

5. Clean shaft with emery cloth and remove bearings.

6. Replace bearings and other parts removed in reverse order.

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REPLACING TRACTOR PTO EXTENSION BEARING

Remove tractor fender-deck. Block fuel tank up out of the way. If tiller is mounted on tractor, remove drive belts from drive sheave as shown on page 90-15-1.

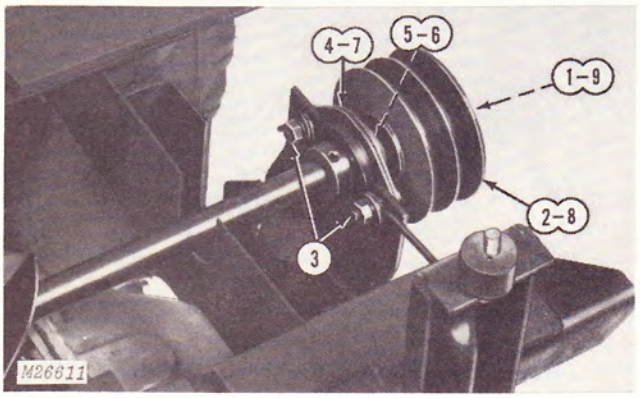

Fig. 22-Replacing Bearing

1. Remove cap screw and washers in end of shaft, Fig. 22.

2. Remove drive sheave and key.

3. Remove nuts and bolts holding bearing flange.

4. Remove outer bearing flange.

5. Slide bearing off shaft, Fig. 22.

6. Clean any foreign material or burrs from shaft and install new bearing.

7. Install outer flange with bolts previously removed. Align bearing and tighten bolts.

NOTE: Adjust belt guides, Fig. 2, page 90-15-1, after belts are installed on sheave.

8. Install key in shaft. Install drive sheave.

9. Install washers and cap screw. Tighten cap screw.

Reinstall drive belts on drive sheave and adjust belt guides as explained on page 90-15-1.

Replace gas tank in position and reinstall fender-deck.

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SERVICING GEAR CASE

Removing Gear Case

Remove tiller from tractor. Remove drive belts from sheaves.

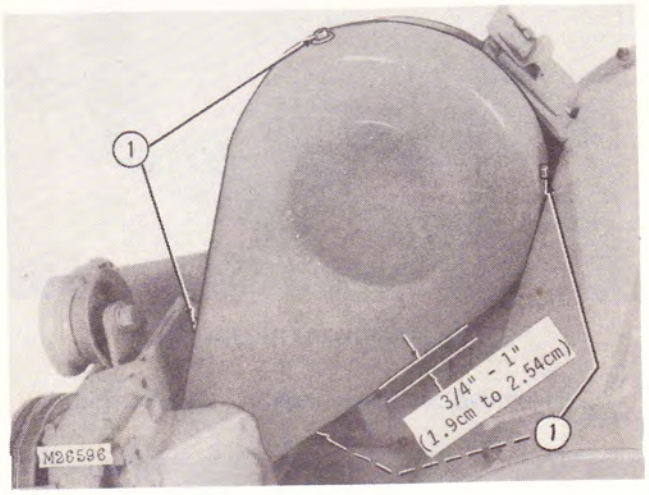

Fig. 23-Removing Drive Chain Shield

1. Remove four screws and drive chain shield, Fig. 23.

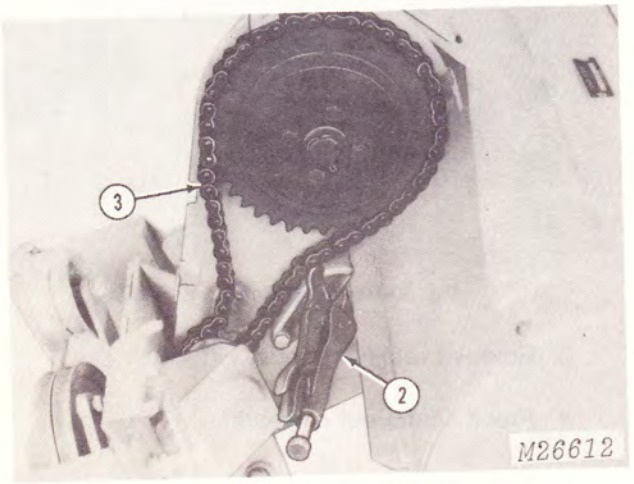

Fig. 24-Removing Drive Chain

2. Compress chain tightener with a locking pliers, Fig. 24.

3. Remove spring clip and coupler link. Remove chain from lower sprocket.

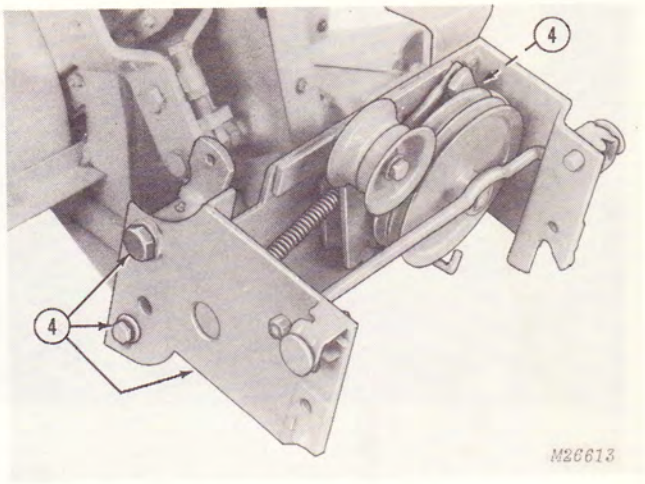

Fig. 25-Removing Mounting Frame

4. Remove three cap screws and mounting frame, Fig. 25. Place mounting frame on a bench.

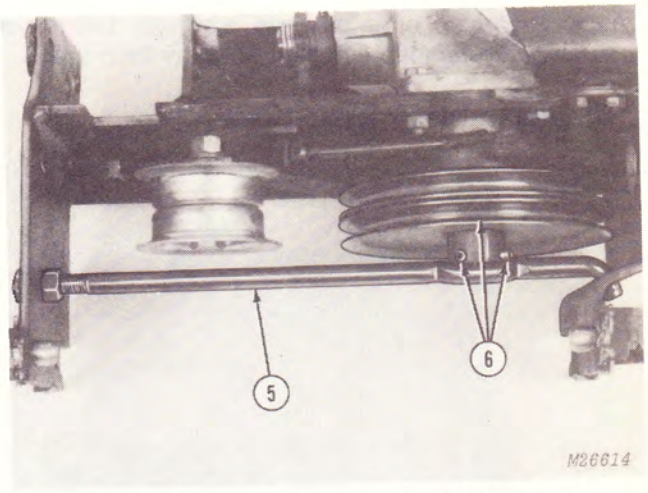

Fig. 26-Removing Driven Sheave and Width Rod

5. Remove width control rod, Fig. 26.

6. Loosen two set screws and remove sheave and key from shaft.

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Removing Gear Case—Continued

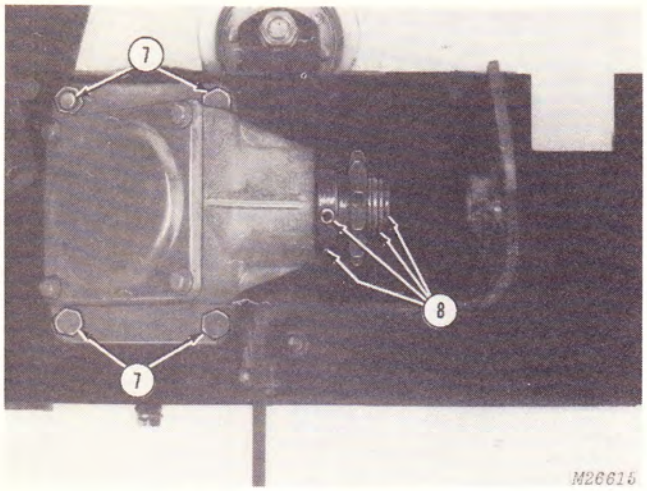

Fig. 27-Removing Gear Case

7. Remove four cap screws, Fig. 27, and gear case from mounting frame.

8. Remove cotter pin and washers. Loosen set screws and remove sprocket and key from shaft.

Disassembling Gear Case

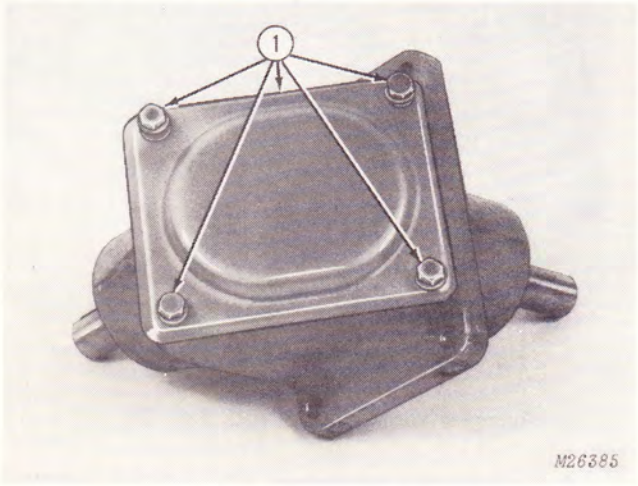

Fig. 28-Removing Cover

1. Remove four screws, cover and gasket, Fig. 28.

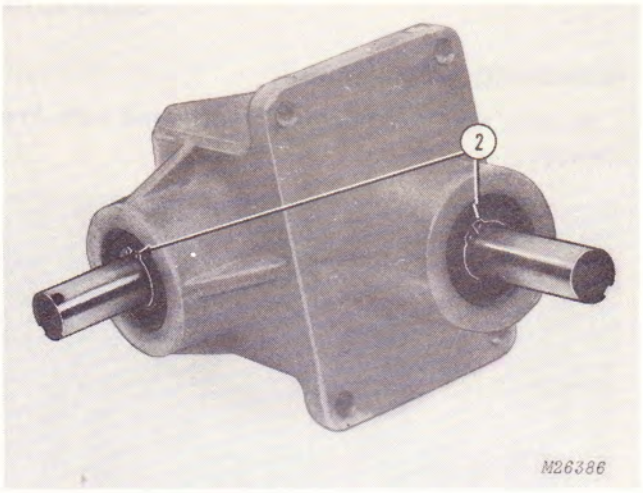

Fig. 29-Removing Retaining Rings

2. Remove retaining rings from shafts, Fig. 29.

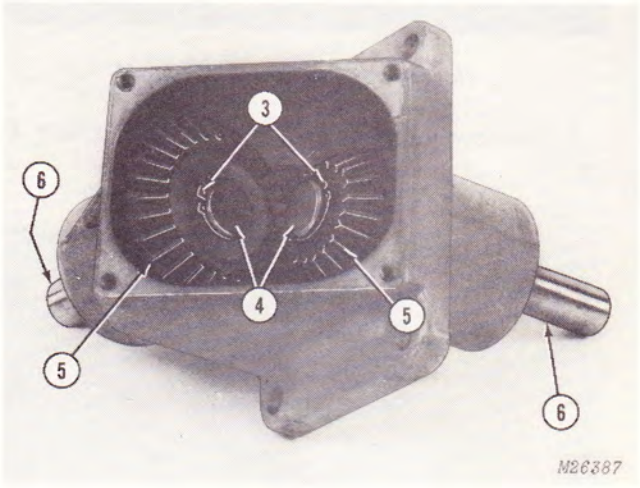

Fig. 30-Removing Gears and Shafts

3. Remove retaining rings, Fig. 30.

4. Press shafts out of gears.

5. Remove gears and keys.

6. Remove shafts from gear case.

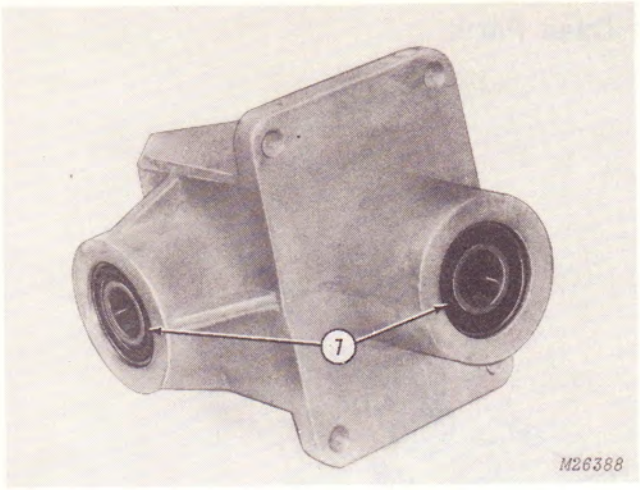

Fig. 31-Removing Oil Seals

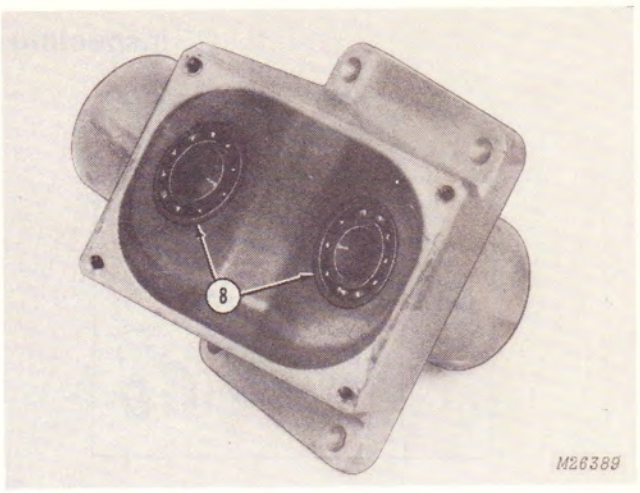

Fig. 32-Removing Bearings

NOTE: Check oil seals, Fig. 31, and bearings, Fig. 32, before removing them. If seals and bearings are not defective, do not remove them. Damage to oil seals will occur if they are removed from case.

7. Remove oil seals, Fig. 31, by prying them out with a screwdriver.

8. Remove bearings by tapping them out of case with a punch, Fig. 32.

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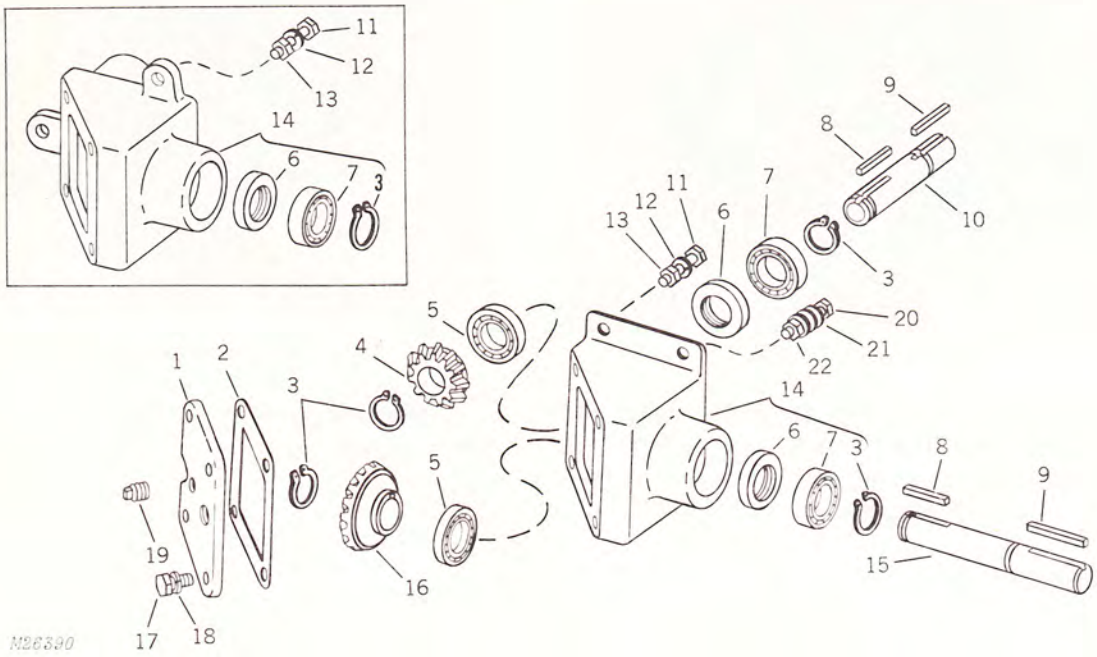
Inspecting Gear Case Parts



Key	Description	Key	Description
1	*Cover	12	3/8″ Lock Nut
2	Gasket	13	3/8″ Hex. Nut
3	Snap Ring (4 used)	14	Gear Case Housing
4	20-Tooth Pinion Gear	15	Output Shaft
5	Bearing (2 used)	16	30-Tooth Gear
6	Seal (2 used)	17	Screw (4 used)
7	Bearing (2 used)	18	1/4″ Lock Washer (4 used)
8	3/16″ x 3/4″ Square Key	19	*Pipe Plug
9	3/16″ x 1-3/8″ Square Key	20	3/8″ x 1-3/4″ Cap Screw
10	Input Shaft	21	3/8″ Lock Washer
11	3/8″ x 1-1/4″ Cap Screw	22	3/8″ Hex. Nut

Fig. 33-Exploded View of 33 Rotary Tiller Gear Case

**NOTE: 33 Rotary Tillers below Serial No. 8930 are equipped with a different gear case housing illustrated in the box, Fig. 33. A different cover with a pipe plug is also used.*

Inspect bearings (5 and 7) for looseness and wear.

Inspect oil seals (6) for cracks or deterioration.

Inspect long input shaft (10) and short output shaft (15) for straightness.

Inspect gears (4 and 16) for worn or broken teeth.

Inspect gear case housing (14) for cracks.

Replace necessary parts.

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Assembling Gear Case

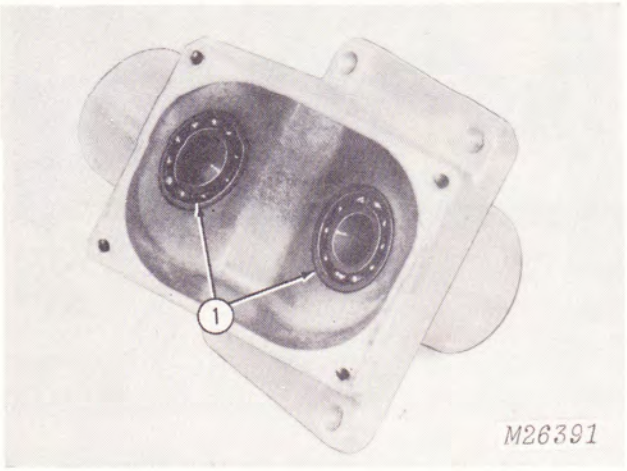

Fig. 34-Installing Bearings

1. Press bearings, Fig. 34, into gear case housing.

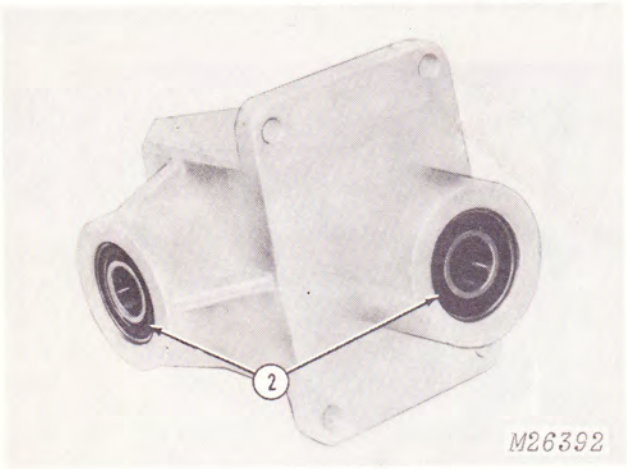

Fig. 35-Installing Oil Seals

2. Coat outside edges of oil seals with Permatex and press into gear case housing, Fig. 21.

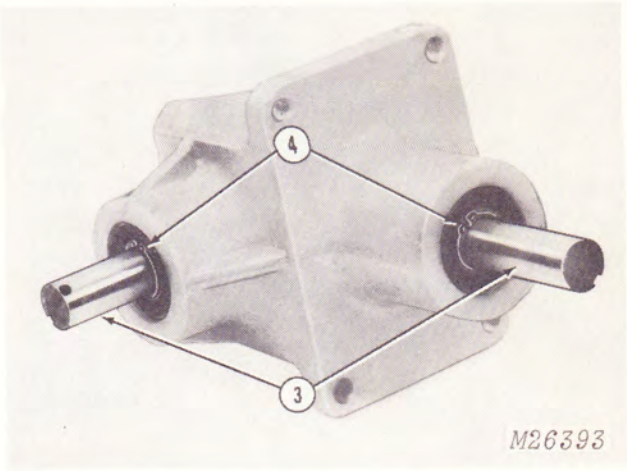

Fig. 36-Installing Gear Shafts

3. Coat gear shafts with oil and carefully slide them through seals and bearings, Fig. 36.

4. Install retaining rings on shafts.

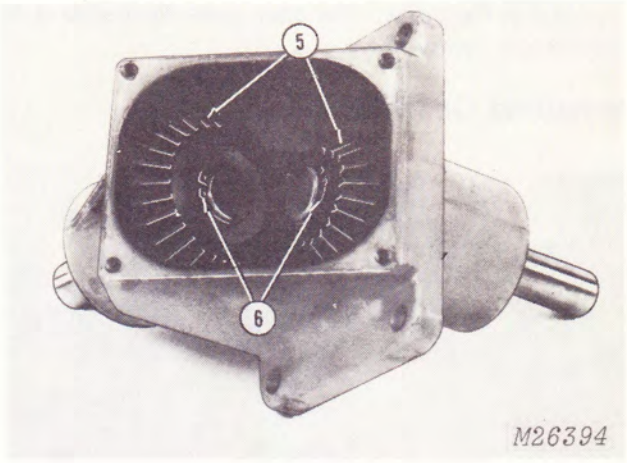

Fig. 37-Installing Gears

5. Install keys and gears on shafts, Fig. 37.

6. Install retaining rings.

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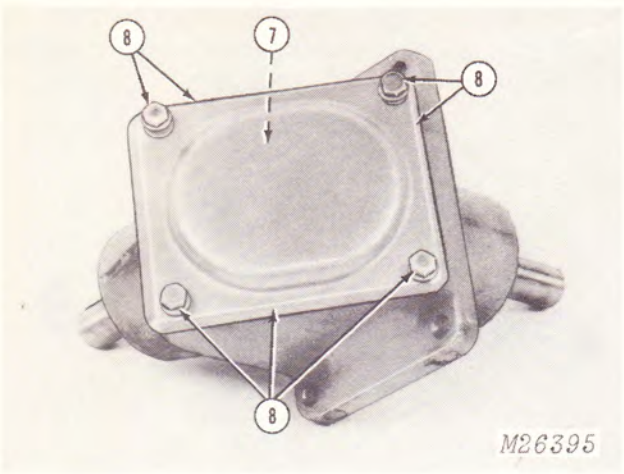

Fig. 38-Installing Cover

7. Place 3 ounces (89 mL) of John Deere AN102562 Corn Head Lubricant in gear case, Fig. 38.

8. Install gasket and cover with four screws and lock washers.

NOTE: Early model rotary tillers are equipped with a different design gear case which has a fill plug installed in the cover. The gear case illustrated is for later model rotary tillers.

Installing Gear Case

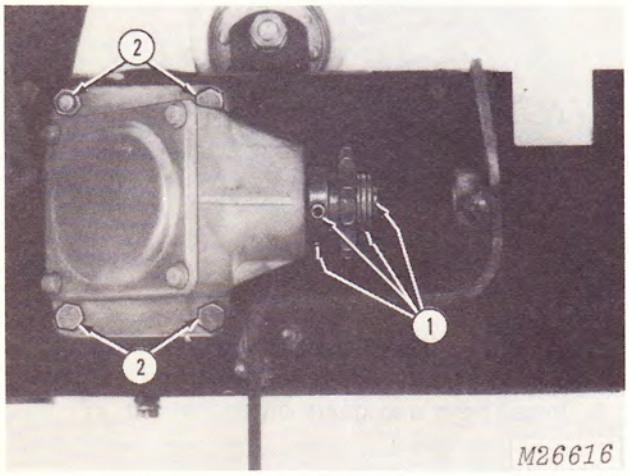

Fig. 39-Installing Gear Case

1. Install sprocket and key on shaft, Fig. 39. Install washers and cotter pin. Tighten set screws in sprocket.

2. Secure gear case to mounting frame with four cap screws, lock washers and nuts.

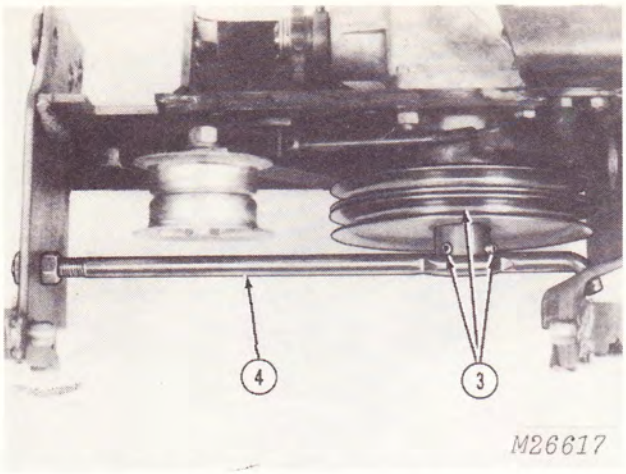

Fig. 40-Installing Drive Sheave and Width Control Rod

3. Place key and driven sheave on gear case shaft, Fig. 40. Apply Loctite on set screw. Install and tighten set screws.

4. Install width control rod.

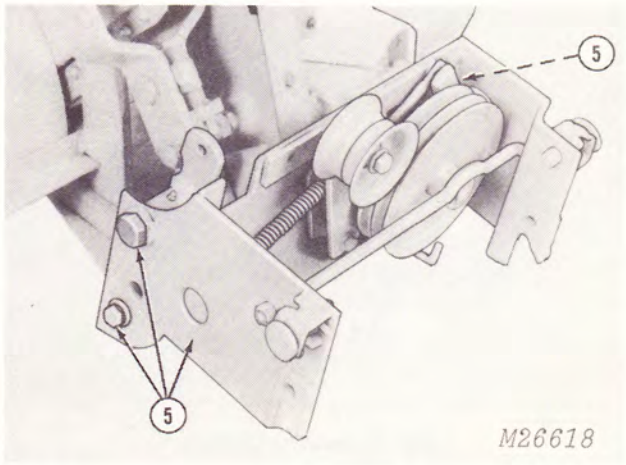

Fig. 41-Installing Mounting Frame

5. Attach mounting frame to tiller with three cap screws, Fig. 41.

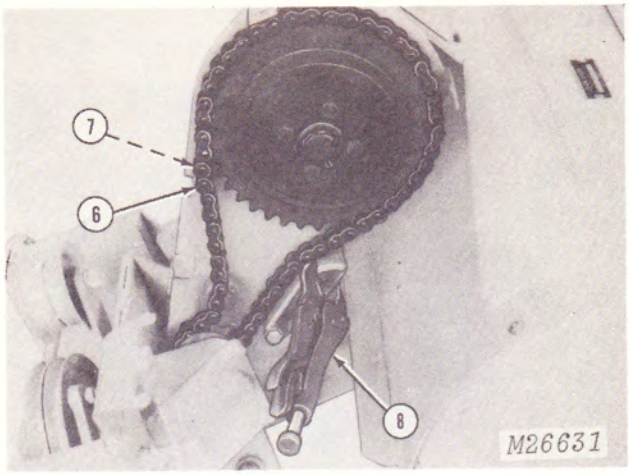

Fig. 42-Installing Drive Chain

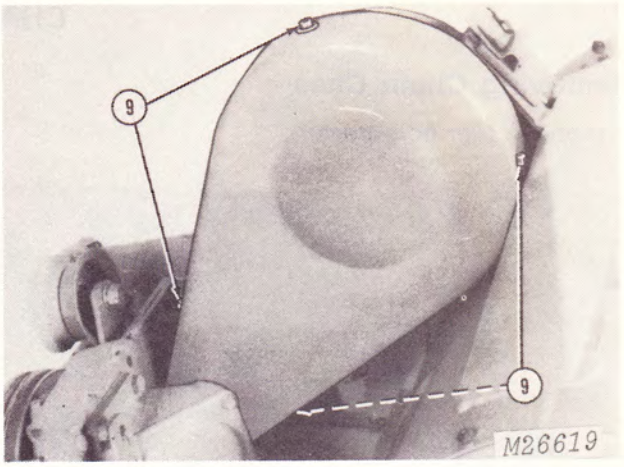

Fig. 43-Installing Drive Chain Shield

6. Place chain around sprocket and install coupler link, Fig. 42.

NOTE: Chain tightener should be compressed with locking pliers to facilitate chain installation.

7. Install spring clip on coupler link so closed end of clip is facing direction of chain travel.

8. Remove locking pliers from chain tightener.

9. Install drive chain shield with four screws, Fig. 43.

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CHAIN CASE

Removing Chain Case

Remove tiller from tractor.

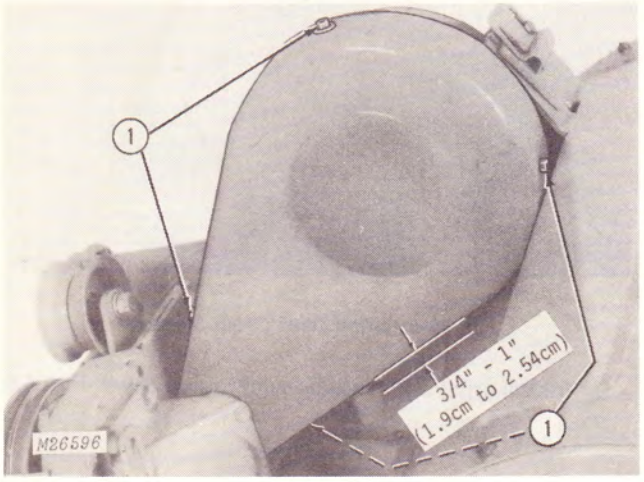


Fig. 44-Removing Drive Chain Shield

1. Remove four screws and drive chain shield, Fig. 44.

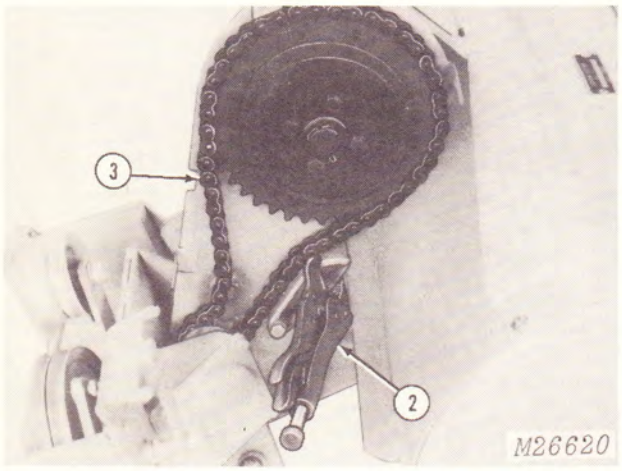


Fig. 45-Disconnecting Drive Chain

2. Compress chain tightener, Fig. 45, with a locking pliers.

3. Remove spring clip on inside of chain. Remove coupler link and lift chain off slip clutch sprocket.

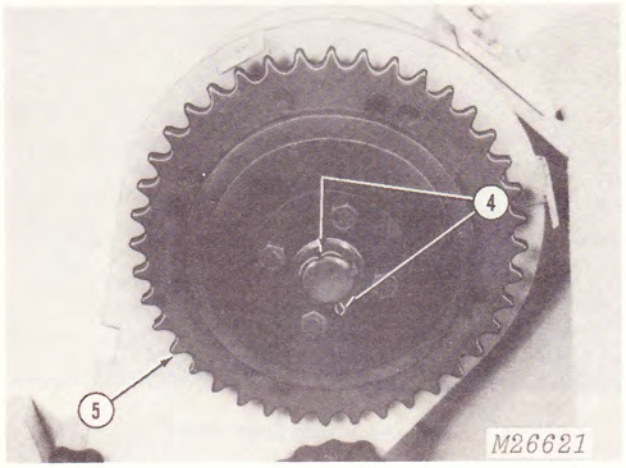


Fig. 46-Removing Slip Clutch

4. Remove cotter pin, Fig. 46, and loosen set screw.

5. Remove slip clutch and sprocket assembly from shaft.

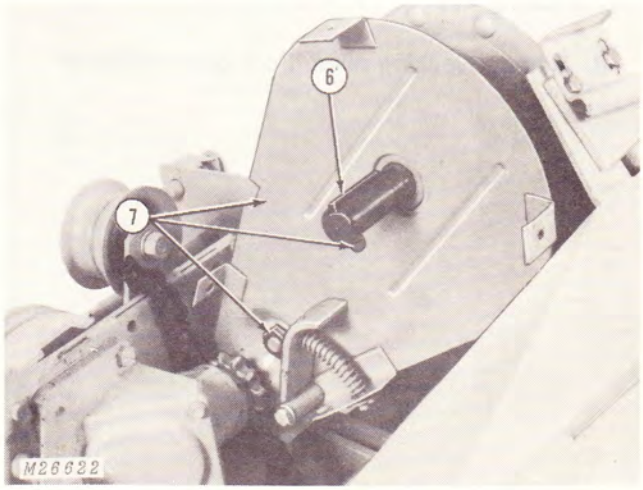


Fig. 47-Removing Inner Chain Guard

6. Remove key from shaft, Fig. 46.

7. Remove nut, flat head machine bolt and inner chain guard.

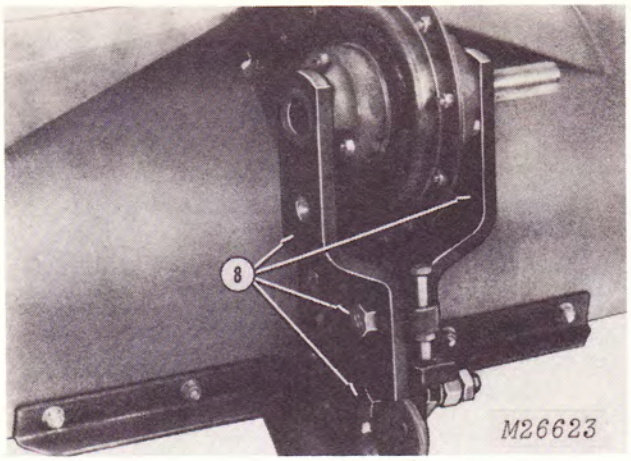


Fig. 48-Removing Link Arms

8. Remove two cap screws and link arms, Fig. 48.

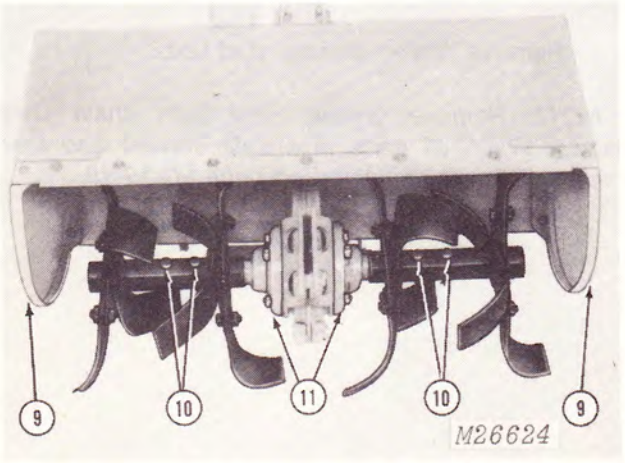


Fig. 49-Removing End Covers Tine Assemblies and Bearing Cover

9. Remove end covers, Fig. 49.

10. Remove tine assemblies.

11. Remove bearing covers.

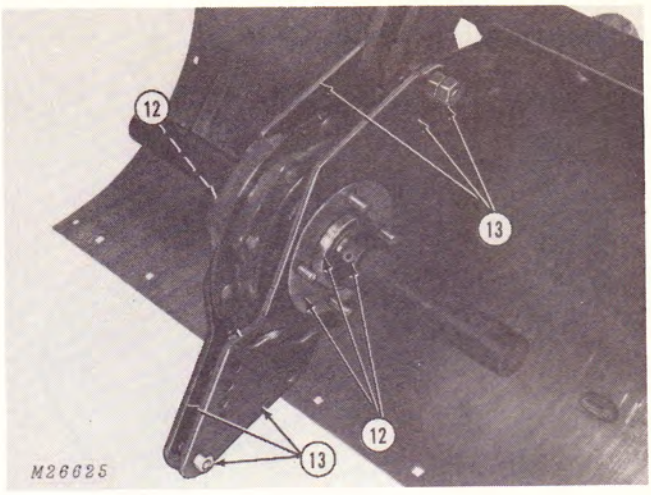


Fig. 50-Removing Collars, Lower Link Plates, Flangettes and Bearings

12. Loosen set screws in locking collars and remove collars by turning them opposite direction of shaft rotation, Fig. 50. Remove bearing flangettes and bearings.

13. Remove lower link plates.

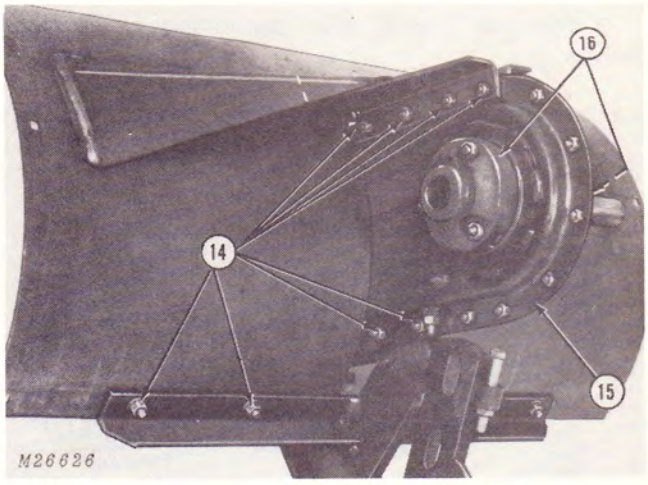


Fig. 51-Removing Chain Case

14. Remove carriage bolts securing chain case to shroud, Fig. 51. Remove shroud.

15. Remove chain case and place it on a bench for disassembly.

16. Remove upper and lower bearing covers, collars and bearings.

Disassembling Chain Case

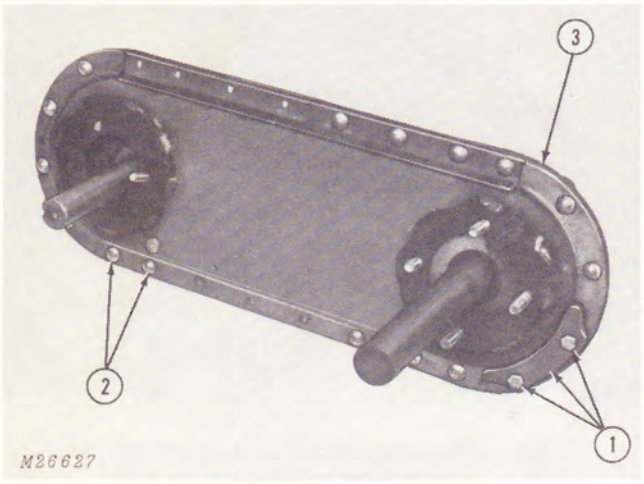


Fig. 52-Separating Chain Case Halves

1. Remove two cap screws and wear plates, Fig. 52.

2. Remove carriage bolts securing chain case halves together.

3. Remove gasket after separating chain case halves.

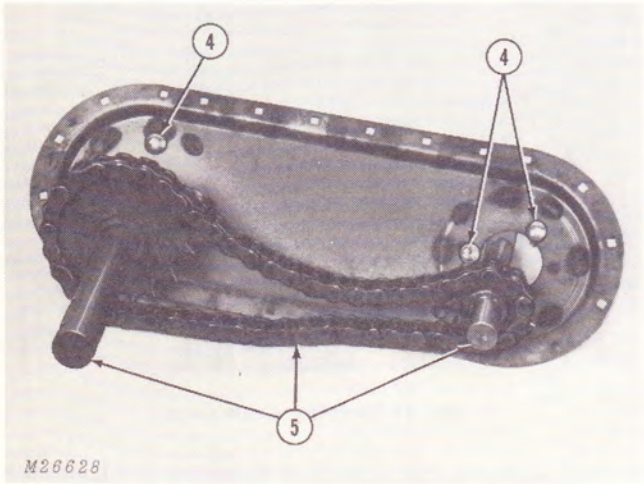


Fig. 53-Removing Carriage Bolts, Chain and Sprocket Shafts

4. Remove bearing flangette carriage bolts, Fig. 53.

5. Remove chain and sprocket shafts.

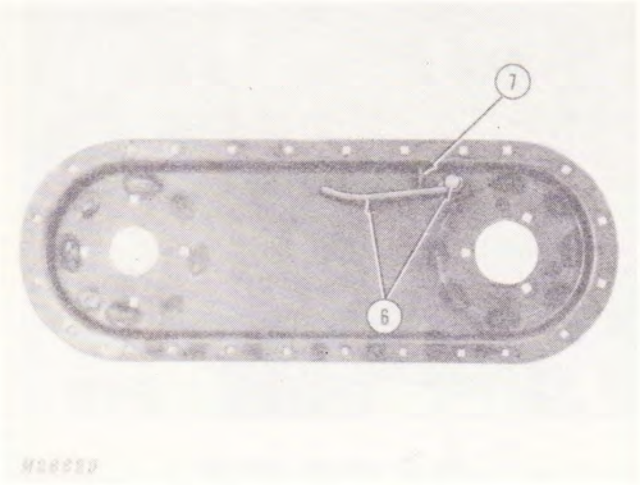


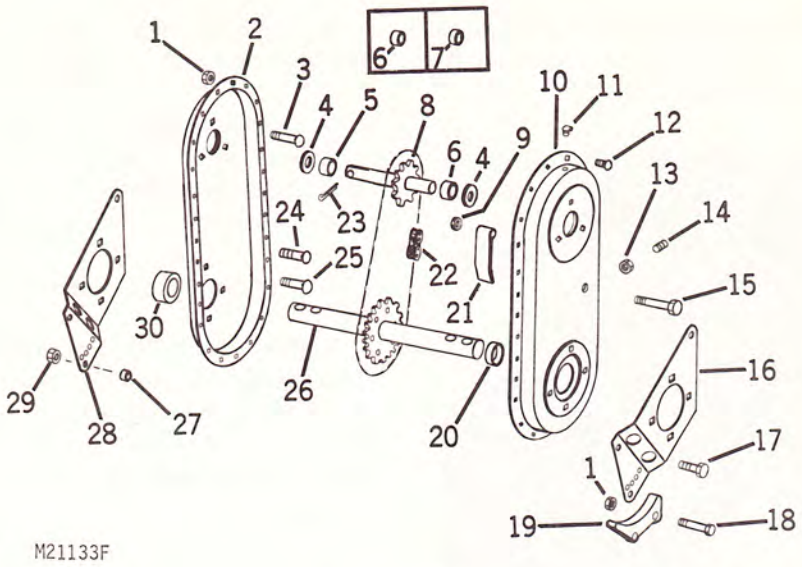
Fig. 54-Removing Chain Tightener

6. Remove cap screw and chain tightener, Fig. 54.

7. Remove chain tightener stud bolt.

NOTE: Remove grease from both chain case halves. Wash all parts in a safe solvent and then inspect them as explained on page 90-15-19.

Inspecting Chain Case Parts



Key	Description
1	1/4" Lock Nut (24 used)
2	Left-Hand Chain Case Half
3	5/16" x 2" Carriage Bolt (6 used)
4	1-1/64" x 1-1/2" x 0.024" Flat Washer
5	Spacer
6	Spacer
7	Spacer
8	Sprocket and Shaft
9	5/16" Lock Nut
10	Right-Hand Chain Case Half
11	Oil Fitting
12	1/4" x 1/2" Carriage Bolt (11 used)
13	5/16" Hex. Nut
14	5/16" x 1-1/2" Set Screw
15	5/16" Cap Screw

Key	Description
16	Right-Hand Pivot Plate
17	3/8" x 1-1/4" Cap Screw
18	1/4" x 1-3/4" Cap Screw (2 used)
19	Wear Block (2 used)
20	Tine Shaft Spacer
21	Chain Tightener
22	Drive Chain
23	1/8" x 1-1/2" Cotter Pin
24	1/4" x 3/4" Cap Screw (4 used)
25	3/8" x 1-1/2" Carriage Bolt (8 used)
26	Lower Sprocket and Shaft
27	Spacer
28	Left-Hand Pivot Plate
29	3/8" Lock Nut (17 used)
30	Tine Shaft Spacer

Fig. 55-Exploded View of Chain Case

Inspect left and right-hand chain case halves (2 and 10), Fig. 55, for damage.

Inspect teeth in sprocket shafts (8 and 26) for wear or damage.

Inspect drive chain (22) for wear.

Replace parts as necessary when reassembling chain case.

Assembling Chain Case

Pack chain case halves with 1-1/2 pounds (0.68 kg) of John Deere Multipurpose Lubricant or an equivalent SAE multipurpose-type grease.

Install a new gasket between chain case halves.

Assemble and install chain case in reverse order of removal and disassembly on preceeding pages. Adjust chain case drive chain after it is installed as shown on page 90-15-20.

Adjusting Enclosed Drive Chain

Raise tiller high enough off surface so tines can be rotated manually. Stop tractor engine and place blocks under tiller to keep it in the raised position.

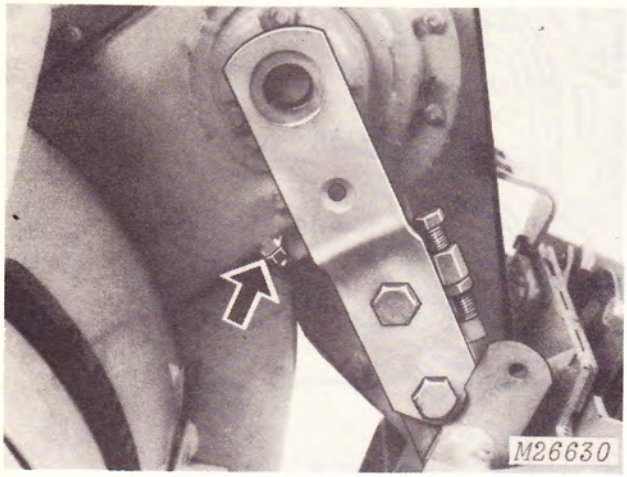


Fig. 56-Adjusting Drive Chain

1. Loosen jam nut (arrow), Fig. 56, on chain tension stud screw.

2. Turn screw clockwise until a slight drag is felt against chain. Use proper size Allen wrench to turn screw.

3. Move tine back and forth manually until chain slack or backlash is felt.

4. Continue turning adjusting stud screw, Fig. 56, clockwise while moving tines until no slack remains and a slight drag is felt on chain. Then, loosen screw 1/2 turn or as necessary to allow tines to turn feely.

5. Tighten jam nut after adjustment.

IMPORTANT: Do not tighten chain more than necessary becuase this will cause excessive wear on drive chain and chain tightener. If chain and tightener are worn beyond adjustment, the chain case will have to be removed from tiller and replaced.

Section 20
542 PTO ATTACHMENT

SERVICING PTO ATTACHMENT

Disassembly

Remove PTO attachment from tractor and place it on a bench for disassembly.

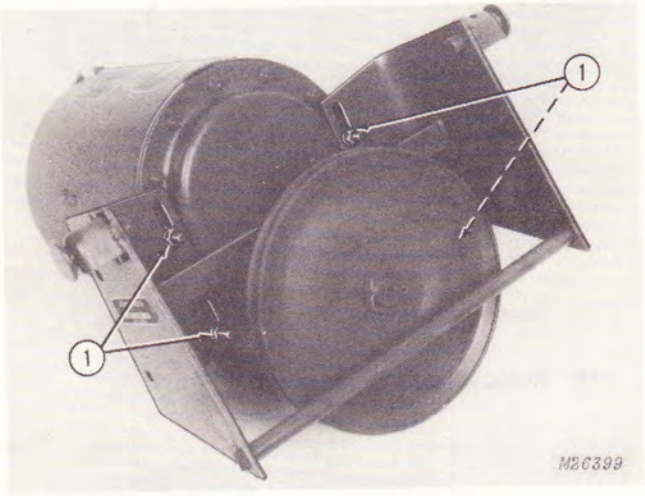


Fig. 1-Removing Mounting Frame

1. Remove four nuts and washers. Remove mounting frame, Fig. 1.

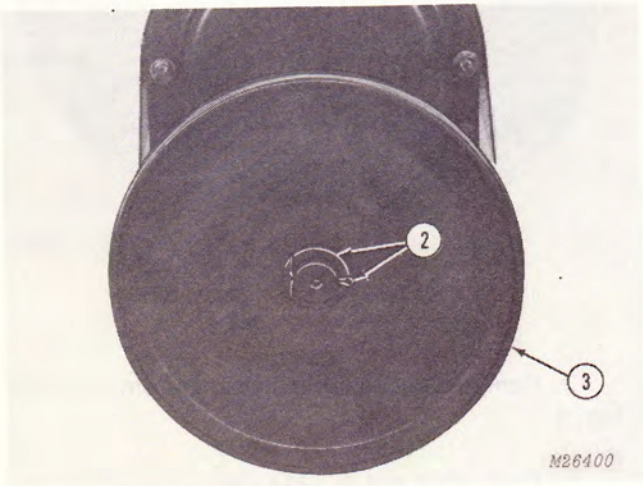


Fig. 2-Removing Sheave

2. Remove cotter pin and large washer, Fig. 2.

3. Slide sheave off shaft.

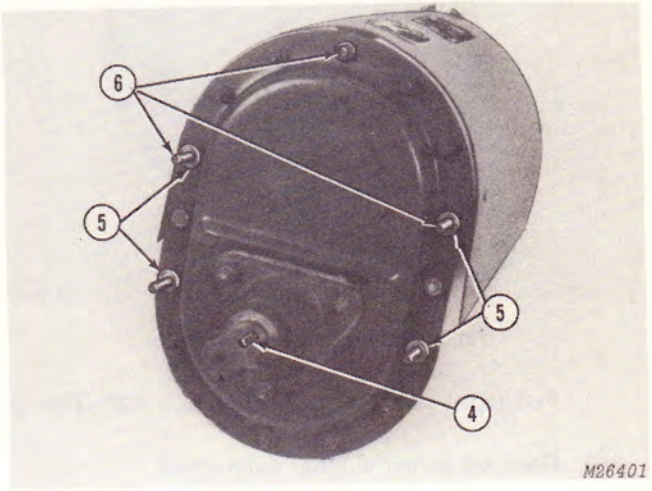


Fig. 3-Removing Shield

4. Remove key from shaft, Fig. 3.

5. Remove four flat washers.

6. Remove three nuts, bolts and shield.

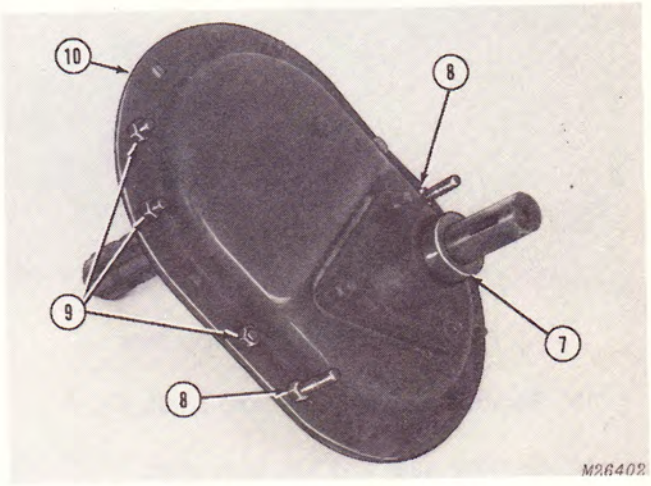


Fig. 4-Separating Gear Case Halves

7. Loosen set screw and remove collar and thrust washer from shaft, Fig. 4.

8. Remove two nuts and long bolts.

9. Remove remaining nuts and bolts.

10. Pry gear case halves apart using a screwdriver.

NOTE: Sealing compound is used between gear case halves.

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Disassembly—Continued

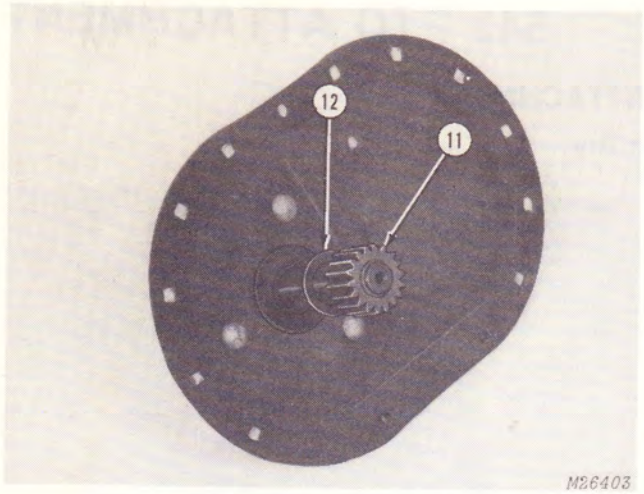

Fig. 5-Removing Input Gear Shaft

11. Pull input gear shaft out of case half, Fig. 5.

12. Remove thrust washer from shaft.

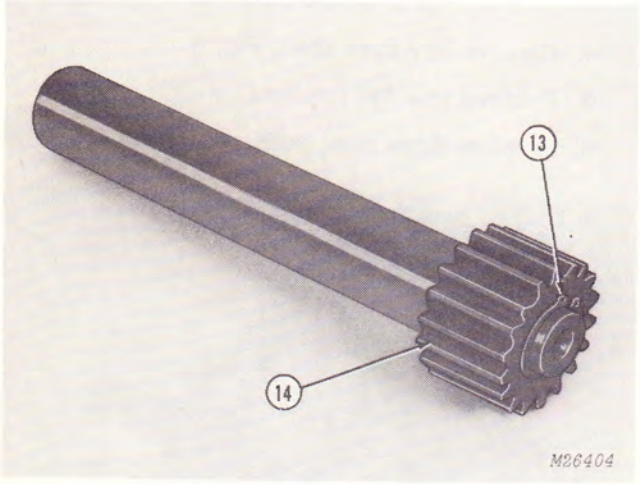

Fig. 6-Removing Gear from Input Shaft

13. Remove retaining ring from shaft, Fig. 6.

14. Remove gear and key from shaft.

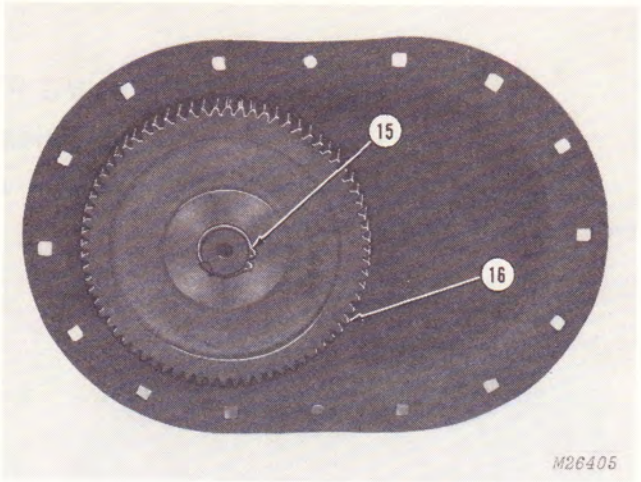

Fig. 7-Removing Output Gear from PTO Shaft

15. Remove retaining ring from shaft, Fig. 7.

16. Remove gear from shaft.

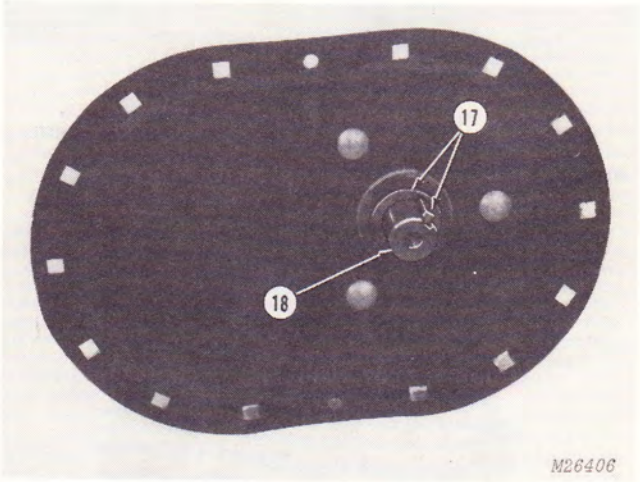

Fig. 8-Removing Key and Thrust Washer from PTO Shaft

17. Remove key and thrust washer from PTO shaft, Fig. 8.

18. Push shaft out of case half.

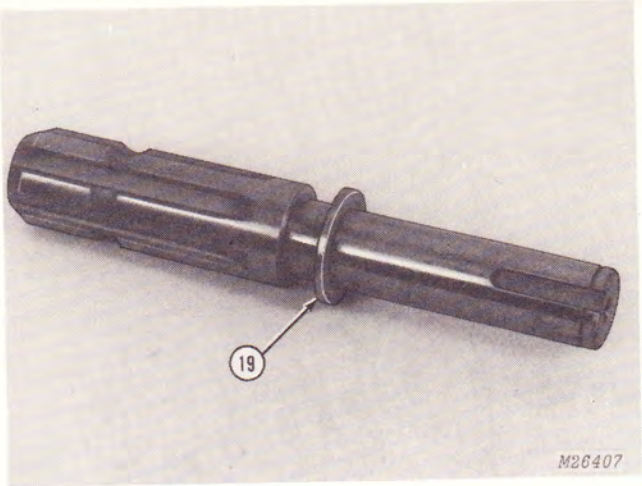

Fig. 9-Removing Thrust Washer from PTO Shaft

19. Slip thrust washer off PTO shaft, Fig. 9.

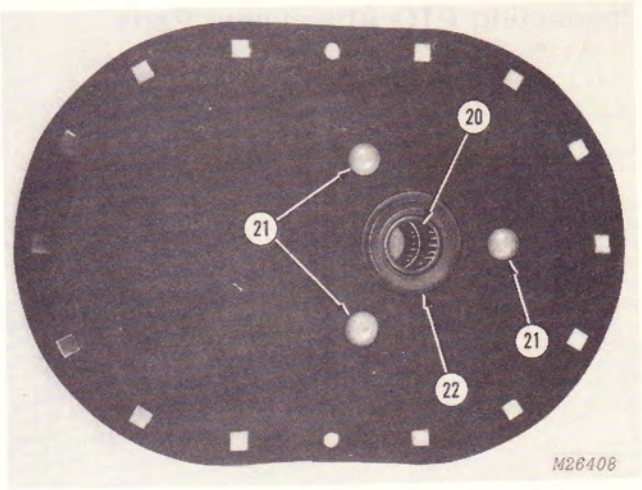

Fig. 10-Removing Bearings and Hubs from Case Halves

20. Using a punch, remove bearings from each hub of case half by tapping down from the back side of bearing, Fig. 20.

NOTE: If hubs do not need replacing, do not remove them. If hubs are defective, remove them as follows:

21. Remove three bolts securing hubs in place.

22. Push hub out of case half. Clean elastic adhesive compound from each case half.

Wash all parts in a safe solvent and inspect them for wear or damage as explained on page 90-20-4.

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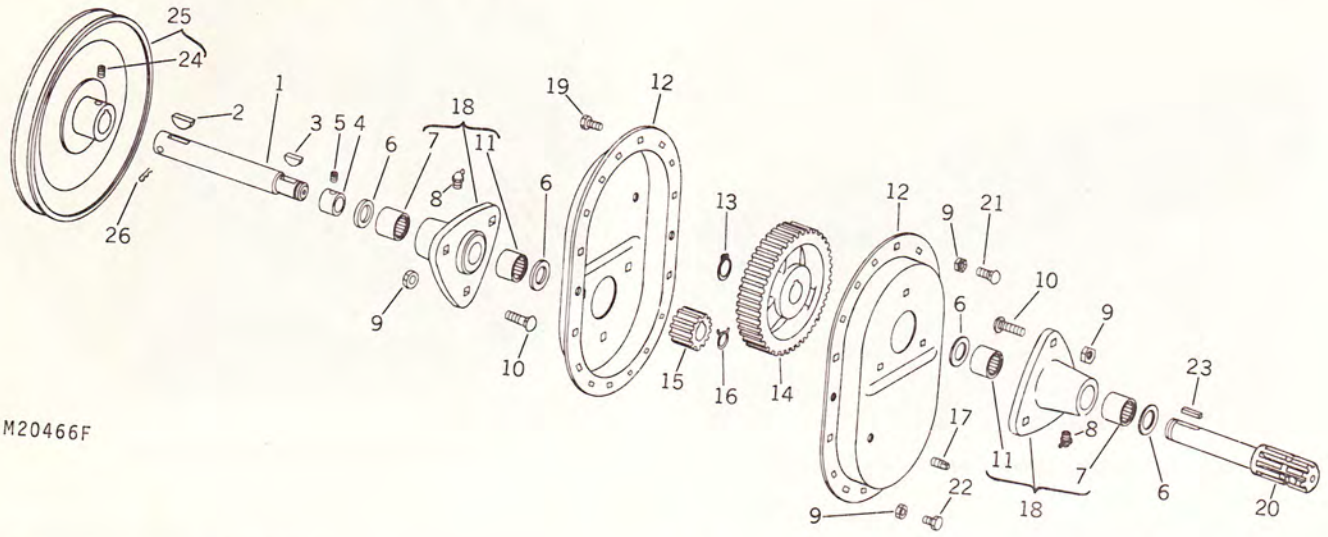
Inspecting PTO Attachment Parts



Key	Description
1	Input Shaft
2	1/4″ x 1″ Woodruff Key
3	3/16″ x 3/4″ Woodruff Key
4	Locking Collar
5	5/16″ x 5/16″ Set Screw
6	Thrust Washer
7	Needle Bearing (2 used)
8	Grease Fitting (2 used)
9	5/16″ Lock Nut (23 used)
10	5/16″ x 1″ Carriage Bolt (6 used)
11	Needle Bearing (2 used)
12	Gear Case Half
13	Snap Ring

Key	Description
14	72-Tooth Driven Gear
15	18-Tooth Pinion Gear
16	Snap Ring
17	Fill-Check Plug
18	Hub
19	Gear Case Breather
20	Output Shaft
21	5/16″ x 3/4″ Carriage Bolt (9 used) 5/16″ x 1-1/8″ Carriage Bolt (Top Case Flange)
22	Gear Case Pilot Bolt (2 used)
23	1/4″ x 1″ Square Key
24	5/16″ x 7/16″ Set Screw
25	Driven Sheave
26	1/8″ x 2″ Cotter Pin

Fig. 11-Exploded View of 542 PTO Attachment Gear Case

Inspect sheave (25) for bent or damaged edges that could cause excessive belt wear or damage, Fig. 11.

Inspect shafts (1 and 20) for straightness.

Inspect bearings (7) for looseness or wear.

Inspect gears (14 and 15) for chipped, worn or broken teeth.

Inspect case halves (12) and hubs (18) for cracks or other damage.

Replace necessary parts when reassembling gear case.

Assembly

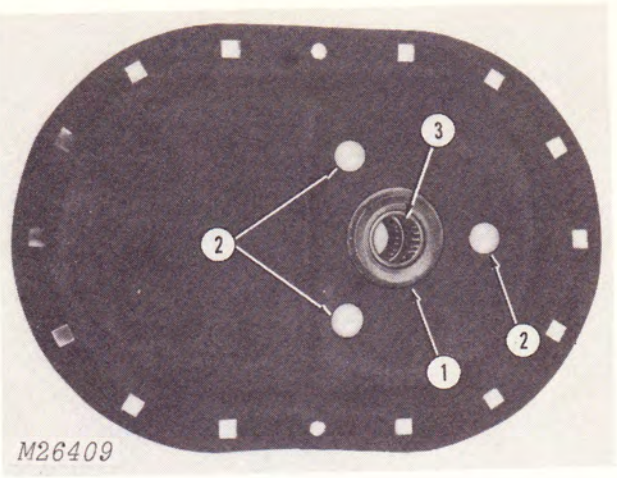


Fig. 12-Installing Hubs and Bearings in Case Halves

Clean elastic sealing compound from hubs and case halves.

1. Apply John Deere rubber silicone sealant (Part No. M64850) on hubs and insert them through case halves, Fig. 12. Be sure there is a liberal amount of sealant on the inside and outside of case halves to prevent oil leakage.

2. Secure hub in place with three 5/16 x 1-inch carriage bolts and lock nuts.

3. Drive bearings into hubs.

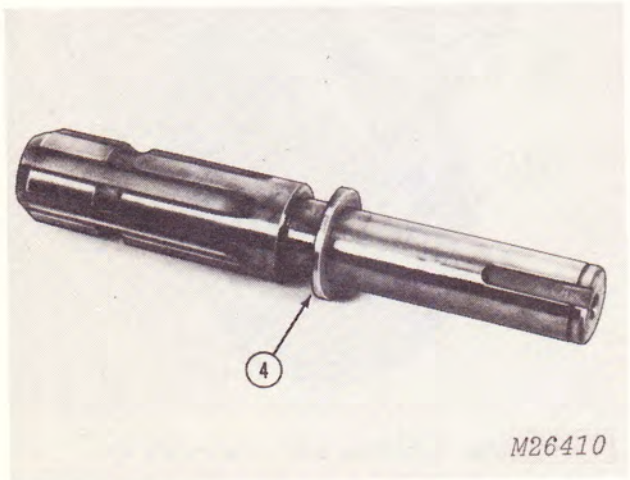


Fig. 13-Installing Thrust Washer on PTO Shaft

4. Install thrust washer on PTO shaft, Fig. 13.

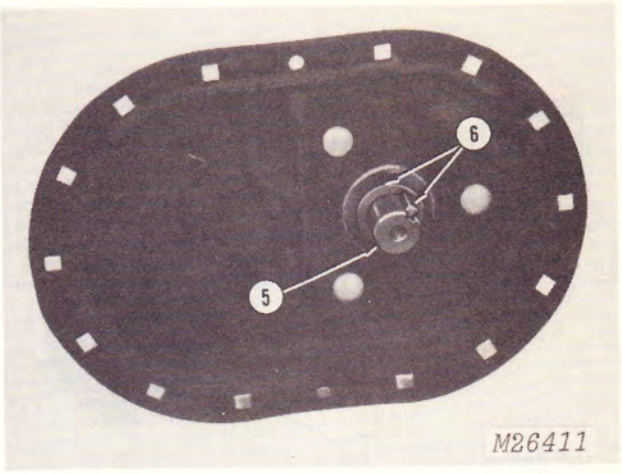


Fig. 14-Installing PTO Shaft and Thrust Washer in Case Half

5. Insert PTO shaft through hub, Fig. 14.

6. Install thrust washer and square key on shaft.

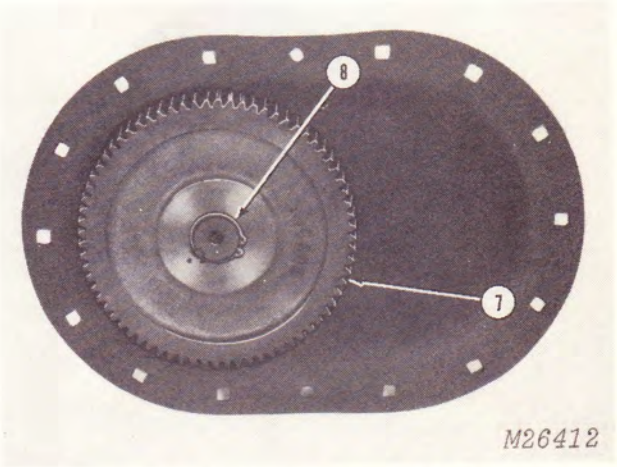


Fig. 15-Installing Gear on PTO Shaft

7. Place gear on PTO shaft, Fig. 15.

8. Install snap ring in shaft.

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Assembly—Continued

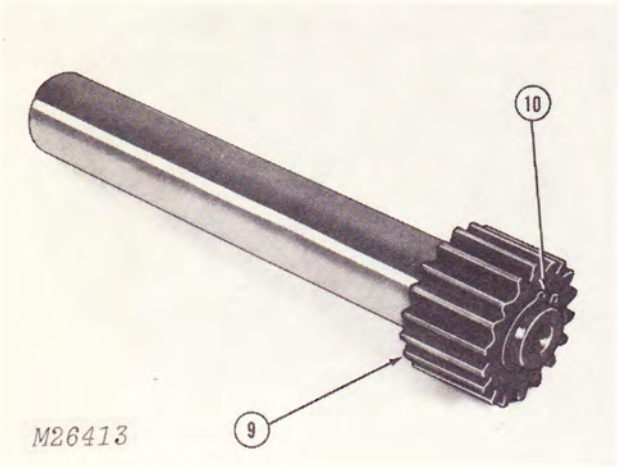

Fig. 16-Installing Gear on Input Shaft

9. Place key and gear on shaft, Fig. 16.

10. Install snap ring.

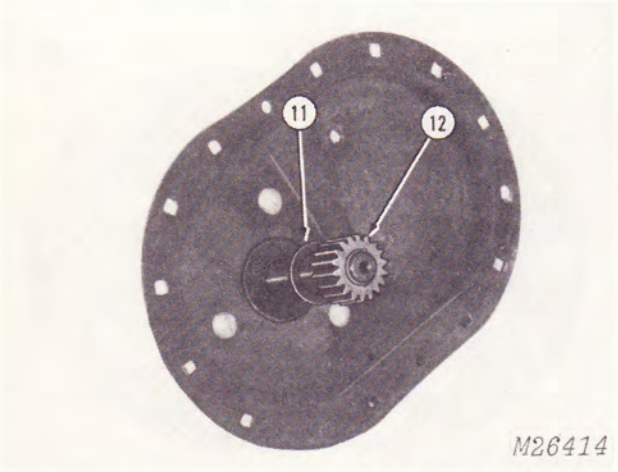

Fig. 17-Installing Input Shaft in Case Half

11. Place thrust washer on shaft, Fig. 17.

12. Insert shaft through case half hub.

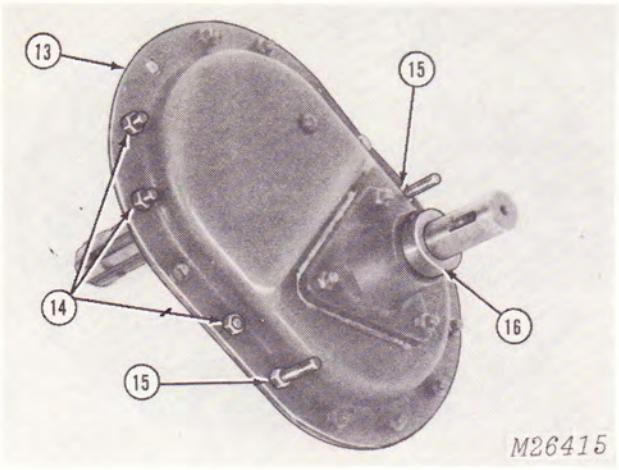

Fig. 18-Assembling Case Halves

13. Apply John Deere Rubber Silicone Sealant (Part No. M64850) over complete flange on each gear case half, Fig. 18.

14. Secure case halves together with 5/16 x 3/4-inch carriage bolts and lock nuts.

15. Install two 5/16 x 1-1/8-inch carriage bolts and lock nuts.

16. Install locking collar and tighen set screw.

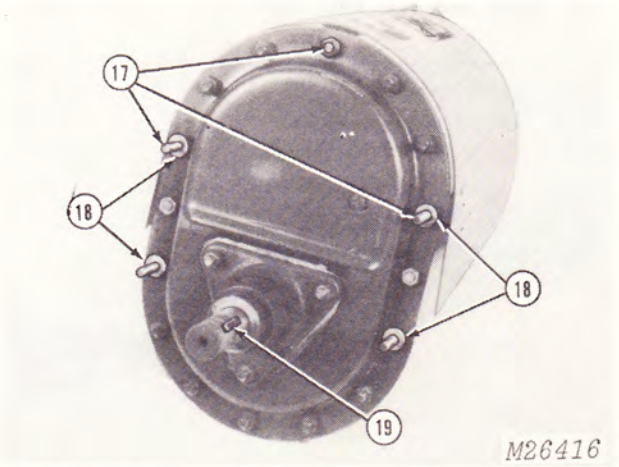

Fig. 19-Installing Bolts, Washers and Key

17. Install two 5/16 x 1-1/8-inch carriage bolts, one 5/16 x 3/4-inch carriage bolt and lock nuts, Fig. 19.

18. Install four flat washers.

19. Install Woodruff key in shaft.

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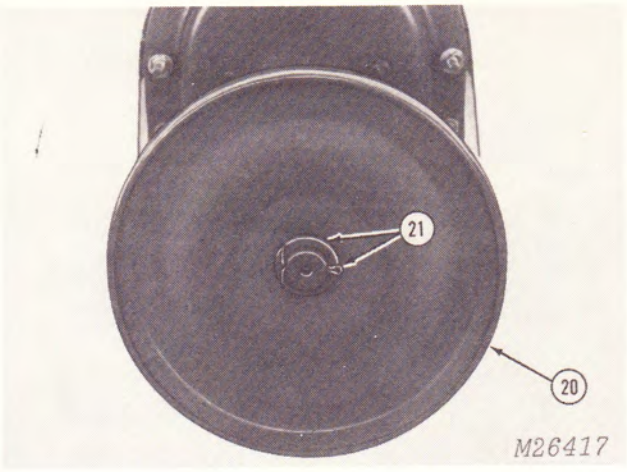

Fig. 20-Installing Sheave

20. Place sheave over key on shaft, Fig. 20.

21. Install thrust washer and cotter pin.

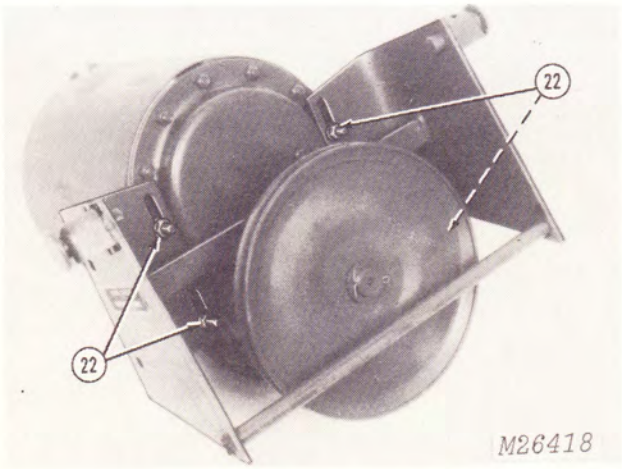

Fig. 21-Installing Mounting Frame.

22. Attach mounting frame to gear case with four flat washers and lock nuts, Fig. 21.

Lubricate gear case as explained at the right above.

LUBRICATION

Place gear case with fill plug up.

Remove fill plug and add 16 ounces (473 mL) of John Deere AM30200 Gear Lubricant (SAE 90) or equivalent.

Reinstall and tighten fill plug.

Litho in U.S.A.